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ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

Drifting With Scraper Slides

By George C. Newton

Anaconda's Walker Mine and Mill

By George J. Young

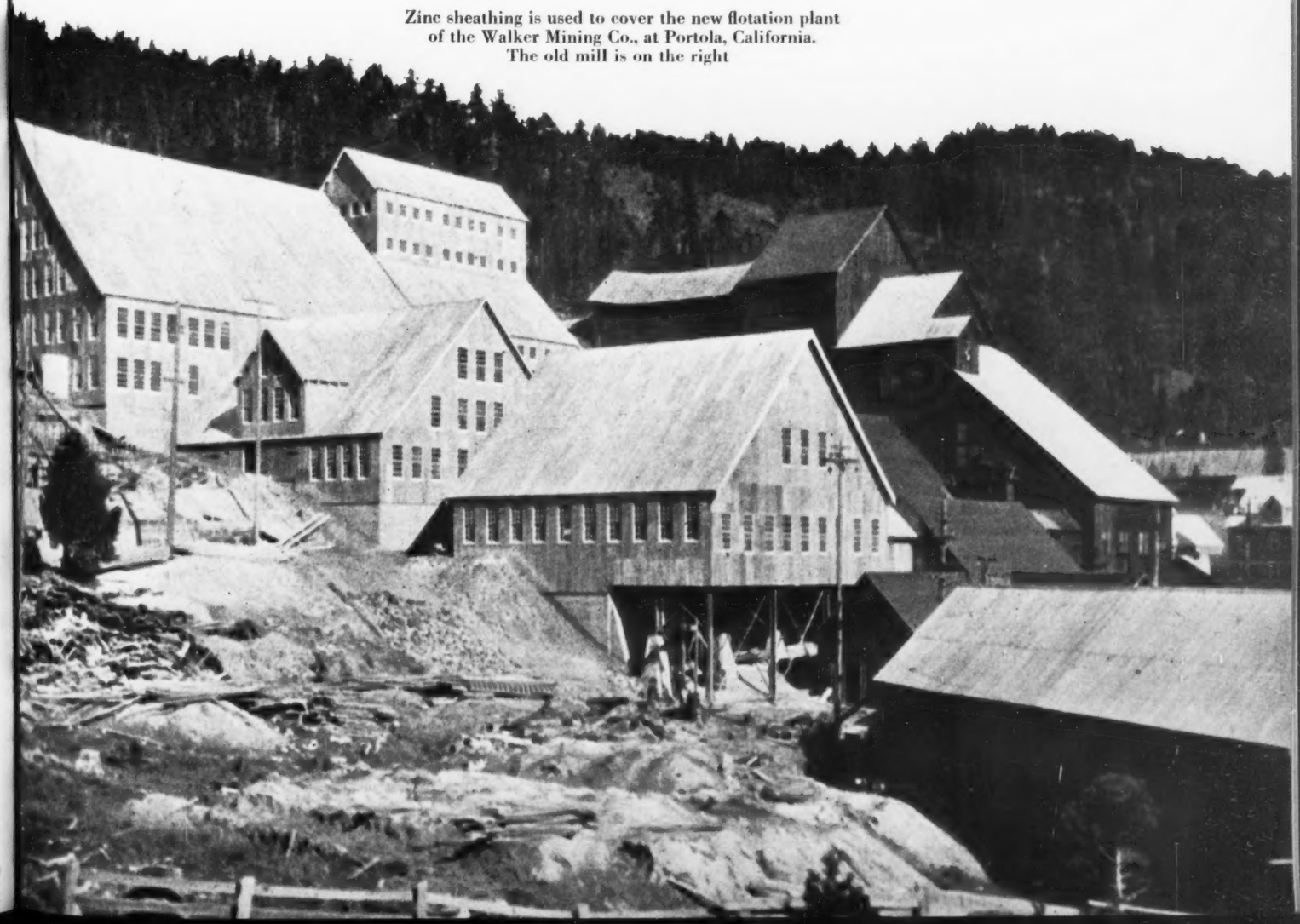
Taxation of Mines in Arizona

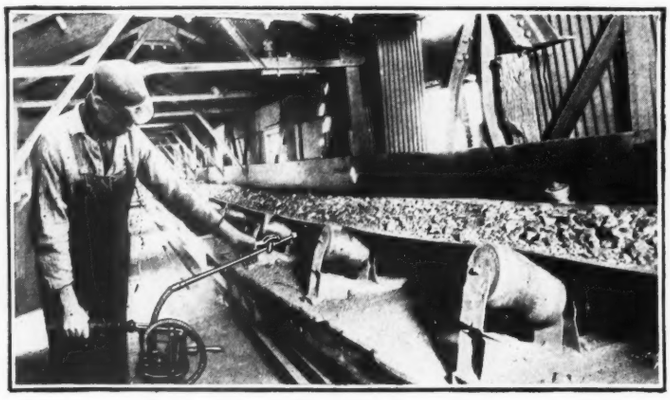
By T. A. Rickard

Lead Smelter Snapshots

By Edward H. Robie

Zinc sheathing is used to cover the new flotation plant of the Walker Mining Co., at Portola, California. The old mill is on the right





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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Consider the Drill

CONSIDER THE DRILL, and how deep a hole it makes. This hole, filled with the right material, and set off properly, becomes the center for a great upheaval. Tunnels are driven; ore is mined; industry booms; the comforts of life increase; evolution is speeded. Consider how the drill accomplishes this; by striking persistently in one place; by concentration and never-ending returning to the attack. If the driller, instead of holding his instrument to one point of attack, changed his mind every few seconds or every few minutes, we should have simply a meaningless fretting and tracing of the surface of the rock, no matter how long the drill kept humming, until it was finally scrapped.

Consider yourself, young man—or man of any age—as the drill. Is your attack on life to be concentrated, or will you scatter your attack over a vast front? Do you look for depth, or breadth? The latter has an alluring sound—a broad experience, a broad education. Yet what is wide must be compensatingly shallow, in drills and in men. The ideal of engineering education held by most of the colleges (with which we agree) is to range around for a while, broadening one's experience, but making no impression on the world, nor conferring on it any benefits; and then to dig deep at one selected point. Only if you forget yourself and keep on ranging, when you at last are scrapped you will still be superfluous.

Much has been written, directly and by implication, as to the doubtful outlook for mining engineers. On the other hand, all the professions are crowded. Everything is crowded; the world is crowded. There is no royal road to affluence opened by any collegiate course. A ceaseless flux and flow levels opportunities: wherever there is a lower level of supply the current of youth rushes toward it instantaneously.

The special opportunity must lie in the man, not in the job. Therefore if you are inclined toward mining, go to it. More ore is mined today than ever before in the history of the world. Ten years from now, more ore will be mined than now. The development of industry, the organization of populations, depend for their raw materials upon the miner's industry. If you cite a case of a mining engineer who has finally gone into real estate, we can cite a chemical engineer who has found his haven in insurance, an educationalist who decided to change to running an apartment house, a lawyer who is glad to be a clerk, or a doctor who has entered trade.

Only—concentrate! Any man is feeble and finite; if he bites off too much he chokes. But if you are not too vain and ambitious; if you modestly, like the drill, select a small area, never cease digging into it: then some time, as Thoreau said, men who want your special knowledge, in which you have dug deeper than others, will form a beaten path to your door.

A Prospector Discovers Platinum

SOUTH AFRICA, the land of mineral wonders, has produced a new surprise. What promises to be the most important discovery of lode platinum ever recorded has been made by a prospector in the Transvaal. An article on the subject, published in the *South African Journal of Industries*, will be summarized in our Book Review department soon. The remarkable feature of the new find is that it is in a quartz vein, which is strong and persistent and occupies a prominent fault plane. The district was worked till 1913 for tin; but the tin deposits are now exhausted. During all the period of years of mining the quartz lode in which platinum has now been found stood up boldly above the surrounding country, a familiar object to prospectors and geologists. Recently, Adolph Erasmus, a grub-staked prospector, determined to wash some gravel in the vicinity; and, starting with an ant-heap, found not only flakes of gold but of a gray metal which lagged behind the gold in the pan. From this behavior he jumped to the conclusion that it must be heavier than gold—and therefore platinum. This surmise proved to be correct, and the platinum was traced to the quartz lode.

The lode, or a chain of parallel lodes, has been located at intervals for a distance of fifteen miles. The main rock formation is felsite (an ancient volcanic rock) and granite, which has intruded the felsite. This is the Bushveld granite, part of a remarkable great differentiated sill, which has close relation to many ore deposits. Besides the quartz, the lode contains locally large amounts of bright green chromiferous chlorite. The platinum is in native form, associated with specularite. The quartz shows banded or comb structure. There is no gold in the lode. Sampling, panning, and assaying are the best means of detecting the platinum.

The ore is believed to represent a magmatic phase, but whether from a highly siliceous or a highly basic magma is in doubt, in the minds of the geologists (Wagner and Trevor) who have described the occurrence. Platinum, together with chrome, has long been known in connection with the basic phases of the Bushveld sill; but not in connection with quartz, or along a definite lode. The occurrence is indeed unique. It is of great interest to prospectors as well as geologists; we anticipate that many a prospector in America will pan the float from apparently barren quartz lodes in the future, looking for the streak that lags behind the gold. The nearest analogy—and that not a good one—which we have to the Bushveld sill is the Sudbury sill, in Ontario.

We rejoice that the discovery was made by a typical prospector, proving the indispensability of this patient and intelligent scout, and the necessity of keeping the breed extant.

The richest ore runs from 10 to 100 dwt. or more per tons, over widths of about five feet. It is estimated

that 3 dwt. would about cover production expenses; and there is probably a considerable quantity of ore above that grade. The bullion contains about 25 per cent palladium, and some iridium. It is anticipated that the South African platinum production will be sufficient to lower the present high prices of about £23 to about £15, but not lower.

The principal company, the Transvaal Platinum, Ltd., has already opened up a considerable tonnage of workable ore, so that there is no question that the fields will soon be producing the metal. Still, the writers whom we are quoting do not anticipate a very large output, since the occurrence of the metal is erratic.

The principal market for the platinum group of metals is in the United States, where 60 per cent is used for jewelry. Should the South African platinum production threaten to be large, we can confidently anticipate a platinum syndicate like the diamond syndicate which now feeds us the gems at the elevated prices which we crave. With this wise type of monopoly, we can see no catastrophic fall in price either of the gem or the platinum settings; so there will always be something to buy at a satisfactorily high price, for if platinum were to fall too much in price, we should be reduced to buying gold jewelry again, and if diamonds should become cheap, we should have to fall back on emeralds or pearls. Neither the producer nor the consumer desires such an untoward situation.

Ironing Out the Peaks in the Lead Price Curve

CRITICISED though it often is, we are disposed to think that the fixed lead price of the American Smelting & Refining Co. is, on the whole, a good thing. As most of our readers know, this price is fixed by that company from time to time, according to variations in supply and demand, and the figure is used as a basis of settlement for all lead-bearing material bought by that company for smelting. It is also used for a large part of the lead that is sold by the company, on contract, to consumers, though, in selling, the prices quoted in *Mining Journal-Press* are frequently the basis of settlement, and a considerable business, chiefly in individual sales of small lots, is done at the best price that can be obtained. But in times of scarcity the Smelting company has shown a commendable desire to prevent a runaway market and has sold such lead as it had available, at its fixed price, even when high premiums might have been obtained for small lots by breaking away from its policy.

Now, with lead prices declining, it will be noticed that the A. S. & R. fixed price is somewhat above that for which lead can be obtained from some sellers. The policy thus makes for stability, and the protection of consumers, so far as is possible, from wild fluctuations in price. Had there been no restraining influence, lead prices in March might easily have soared above 10c. per lb.; in fact, the price might have gone above that of copper. And then, in April, the price would have dropped perhaps three or four cents in a week. This would have been a bad condition, for with the excessive prices, production would have been unduly stimulated and consumers would not only have been obliged to make violent changes in their prices for finished lead products, but would probably have turned to substitutes where possible. Then, with the weakening in the market, the stage would be set for a reaction.

The idea behind the fixed price is, of course, to make conditions more agreeable for the A. S. & R.; to prevent, so far as possible, the forced reception of a large amount of lead-bearing material at fancy prices, followed by sale of the lead a month or so later, after it has been smelted and refined, at a loss at greatly depressed prices. But this moderate amount of price fixing, like that of the U. S. Steel Corporation, we believe to be for the good of the industry. It has none of the evils of a complete and country-wide price-fixing policy from which we suffered during and immediately after the World War.

Spring an Appropriate Time to Begin

WE HAVE RECEIVED a large sheaf of "literature" from the National Clean Up and Paint Up Campaign Bureau, with the suggestion that if our "newspaper" should get behind this movement some good advertising, doubtless from the paint and broom manufacturers, would come our way. The circular letter says "Please don't let anybody call this campaign a 'week,' unless it be as the 'opening week' of a continuous campaign."

This brings to our mind how, when we were working in a certain plant, there used to be a great period of activity about the works once every year. This, as it happened, was always just before the expected visit of the directors from New York. When they arrived there was not a piece of old drill steel, a worn-out trommel, or a broken casting to be seen. The old conveyor belt which we had walked around for the last ten months had been cut up into stair treads. All the eyesores had vanished.

Now, we think this was a good thing, that it had a good effect on our work, and we would like to call it to the attention of the managements of those mines, mills, and smelters who do not entertain their high officials from New York at regular intervals. In tramping about through the various mining plants of the country we notice a vast difference in the way they are kept up; furthermore, it is usually the prosperous company that has the well-kept plant. Cause and effect, you may say; the prosperous company can afford it. But we suspect that, in the language of the chemist, to some extent at least, the reaction is a reversible one.

Widespread Economies in Precipitation Phase of Cyaniding

FEW INNOVATIONS in the development of the cyanide process have met with the widespread success that has resulted from the adoption of Mr. T. B. Crowe's practice of deoxidizing solution before precipitation. In addition to economies in the consumption of zinc and cyanide, the modification is an aid to higher extraction of gold, because of better precipitation. In addition, one bugbear of operations with low-grade solutions—the formation of white precipitate—is avoided.

At the Shamva mine, in far-off Rhodesia, according to Mr. C. E. Parsons, who contributes to the April bulletin of the Institution of Mining and Metallurgy, the amount of gold in the zinc-box tailing has been reduced, by adopting the modification, to a trace or occasionally to one to two grains per ton. And a high-

grade gold slime results, requiring less flux in smelting. The increased efficiency of precipitation permits the use of only four- or five-sevenths of the number of compartments in each box, with obvious labor-saving advantages.

A mistaken idea is prevalent in some quarters that the deoxidizing of solutions is only applicable where zinc dust is used as the precipitant. The results at the Shamva controvert this, the introduction of the Crowe process having resulted in an economy of about $3,000 per month. The simplicity of the procedure needed to effect so radical a saving suggests that a wider field exists for the modification if metallurgists and executives would investigate its application to their own problems. The most practicable method of augmenting the output of gold is by increasing extraction and reducing costs. The Crowe modification has been signally successful in achieving both.

Basic Principle of L.O.X.

WHEN G. H. Clevenger spoke on liquid oxygen explosives recently at an eastern school, the student paper in announcing the lecture made the following pithy statement:

"The idea was originated in Germany and continued in this country by Mr. Clevenger and an associate. In brief, it makes use of the amount of heat taken up by liquid oxygen in vaporizing to cause rock or ore to contract more suddenly than it can stand, shattering the rock. The industry is only in its infancy in this country, but it is rapidly growing in importance, although of course opposed by manufacturers of ordinary explosives."

A good though ludicrous attempt at an explanation by one who evidently did not know of the carbon absorbent used! How else could liquid oxygen rend the rock, if nothing were present with which it could combine! For those unfamiliar with this new kind of explosive, it may be said that liquid oxygen explosive, or L.O.X., is made right at the face where the blasting is to be done and immediately before charging the holes. Sticks or cartridges of lampblack carbon, wrapped in blotting or other absorbent paper, are immersed in liquid oxygen, which is carried to the face in especially designed containers, built with double walls on the principle of the vacuum bottle. The carbon sticks soak up the liquid oxygen, and, after a brief period of immersion, are removed from the container in a frozen condition and are immediately loaded into the holes which are to be shot.

The charge is exploded with the ordinary cap and fuse, or with electric exploders. The carbon-oxygen mixture is, of course, a powerful explosive, but the oxygen begins to evaporate as soon as the sticks are removed from the container, and, as a result, the charge in the holes becomes inert within about thirty minutes after loading, thus necessitating firing without delay. This is at once a disadvantage and an advantage of this explosive.

To keep innocent youth from such misconceptions as the one recounted, some one should devise a name that will properly indicate the character of this type of explosive. "Liquid oxygen" tells but half the story. The oxygen is but half of a closely united couple—the better half perhaps. An explosive combination, but one differing from most couples in that a flare-up only binds the two component parts more closely!

Canned Speeches and Standardized Entertainment

THE CANNERY INDUSTRY has done much for humanity. Particularly is this so in the mining industry, for there are relatively few mining camps that are so situated as to provide for fresh fruits and vegetables for more than a limited period of the year. Dried fruits and canned goods play a substantial part in the well-being of the industry. However, canning can go too far when applied to other than foodstuffs. We refer to the Public Speakers' Society of Harrisburg, Pa. Of the inner organization we know not. Whether by a small annual fee the ubiquitous individual can become a member, as in the instance of the National Geographic Society or like institutions, is not apparent from the circular we have received. However, this evidently commercial organization offers to furnish "a collection of 100 prepared speeches (No. 1 to 100) on the most called-for subjects for only $5 prepaid, or a single speech which we have already prepared, but not listed on the enclosed circular, for $1.25; or we will prepare a speech especially for you on any desired subject at the rate of $4 per 1,000 words." Speeches can also be obtained in bound-volume sets. Three hundred "snappy stories" are offered for $2. A similar collection of toasts is offered for a like sum. One can also get seventy funny stunts for a dollar. Evidently, the field has been covered.

Exuberant commercialism knows no bounds. We have considerable sympathy for the writers of these canned speeches, snappy stories, and stunts, for we are writers ourselves. To the idea of the canned speech we are opposed. We believe in sincerity. Standardization of addresses, recitals of set speeches, must necessarily fail generally, however successful they may be in a few instances. An address, whether read from a paper or not, should represent the orderly thought of the individual upon the subject. The evident sincerity of the speaker, the fact that the content of the address is his own thought, is the valuable part of the contribution both to him and to his audience.

Canal Prosperity and the Petroleum Industry

THE TOLLS collected from ships passing through the Panama Canal now aggregate over $70,000 per diem, which shows a considerable increase in recent years, due largely to the heavy movements of petroleum from California. An analysis of official statistics shows how important a bearing the petroleum industry has on the economics of Canal traffic. In May, 1923, about 48 per cent of all tolls collected from vessels passing through from west to east were paid by tankers dispatched from Los Angeles Harbor. The total tolls paid in this month aggregated $519,694.61; the same class of vessels, empty, going in the opposite direction paid $587,037. In October, 1923, sixty-seven eastbound ships out of Los Angeles, carrying 780,082 tons of petroleum, paid $421,704 in Canal tolls; in the same month 71 empty tankers returning from the east paid $316,678.

The successful financial operation of the Canal has been due largely to activity in the petroleum industry, and particularly to the enormous output from California in recent years.

Lead Smelter Snapshots

Missouri Concentrates Treated in Three Plants Near St. Louis—Newnam Ore Hearths for High-Grade Material, Blast Furnaces for Low-Grade, Preceded by Sintering

By Edward H. Robie
Assistant Editor

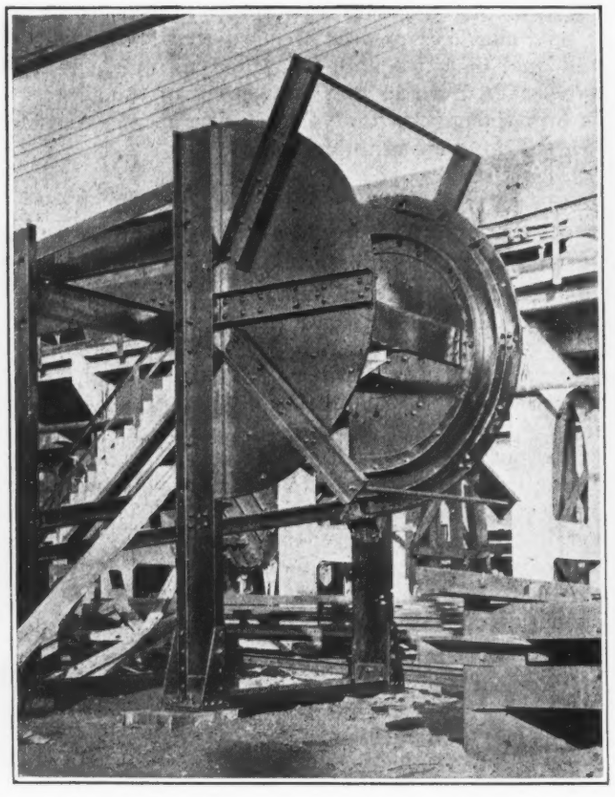
MISSOURI is the most important lead-producing state; it is responsible for about half the United States output of that metal. The deposits occur in two districts, one in the southeastern portion of the state, where lead is the only product, and the other in the southwestern part, where lead is secondary in importance to zinc. But all of the lead concentrates are smelted around St. Louis, the three plants now operated being those of the St. Joseph Lead Co., at Herculaneum, Mo.; the Federal Lead Co., a subsidiary of the American Smelting & Refining Co., at Federal, near East Alton, Ill.; and the St. Louis Smelting & Refining Works, a subsidiary of the National Lead Co., at Collinsville, Ill. Both of the Illinois smelters can be reached within an hour by electric cars from St. Louis.

Federal Smelter Being Enlarged

When I visited the Federal plant about five months ago the contract had just been signed whereby a large part of the concentrates produced by the St. Joseph Lead Co. is being smelted by the Federal. Accordingly, plans were being made to increase the capacity of the plant from 7,000 tons of pig lead per month to 15,000, and the enlargements will probably be completed during 1924. Two methods of smelting are used, Newnam ore hearths and blast furnaces, the equipment in use at the time of my visit including fourteen of the hearths and two blast furnaces.

The ore hearths are used for smelting the high-grade concentrates—those running over 68 per cent as a rule. The gravity concentrates from the southeastern Missouri mills run about 70 per cent lead, the flotation concentrates about 50 per cent, and the concentrates from southwestern Missouri about 80 per cent. For the ore hearths, the southeastern and southwestern concentrates are mixed, and about 8 per cent of coke breeze is added as fuel. The air pressure is about 7 oz. If the charge is of too low grade, too much slag is produced, which makes operation of the hearth difficult. A charge containing as low as 62 per cent lead has been successfully smelted at the Federal plant, but only after it had been weathered for some months. On a charge to which it is adapted, it is said that lead concentrates can be smelted in a Newnam ore hearth for about $2 a ton less than in a blast furnace. Two men work at each hearth, and the production is from eleven to twelve tons of lead per day.

In the blast furnaces, the lower-grade ore and the by-products are smelted. First, such material is sintered in two Dwight & Lloyd sintering machines of the usual



Dwight & Lloyd frame, showing increased stiffening at discharge end, and use of rails

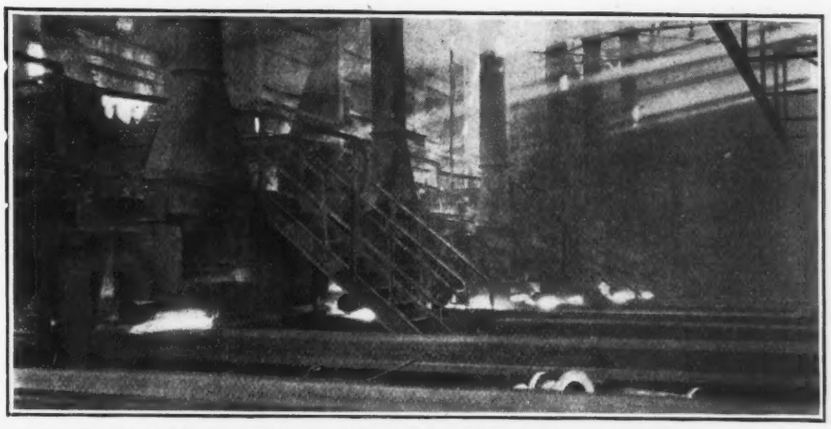
Discharging sinter on a grate and thence into a car, where it is sprayed

type of construction, using the "Trail" or "Stewart" type of cast-iron grate. Samples of malleable iron grates have been tried, but were not satisfactory. The combustion chamber for the ignition flame is composed of two I-beams bolted together and lined with clay. In the D. & L.s the sulphur is brought down from about 14 to 9 per cent. The sinter is sprayed with water, crushed in a jaw crusher, and discharged into H. & H. pot bowls. There are, or were, at the time of my visit, fourteen of these H. & H. pots, in which the sulphur is further reduced to about 2½ per cent for the blast furnaces. The pots are 42x144 in., but it was planned to have the new ones, to be used in the enlarged plant, about 48x196 in.

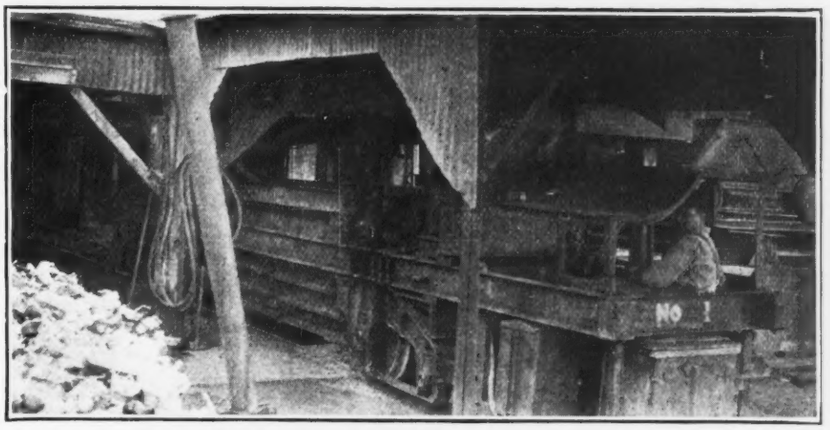
The blast-furnace charge is assembled from different bins, in hand carts, but it is planned to make this up in one bin, thus doing away with considerable labor. About 9½ per cent of fixed carbon on the charge is required. Lead flows continually from the side of the furnace, and slag and matte is tapped occasionally from the end into a portable fore hearth. Slag, containing 1 per cent of copper or less, overflows into another pot, and is then taken to the dump. The matte, containing about 17 per cent copper and 20 per cent lead, is also taken to the dump, but will no doubt be re-treated some day.

Lead from both the hearths and blast furnaces is softened in a small coal-fired reverberatory furnace and tapped into a 40-ton kettle. There it is blown with steam for an hour or two to oxidize impurities, largely copper, which are skimmed off by hand, cast, and recharged to the blast furnaces. The lead is then cast as "Federal" lead, of so-called "chemical" grade. None of the lead is desilverized. In the new plant a 110-ton kettle is planned, and improved casting and loading facilities, similar to those in use at the Collinsville plant, to be described later.

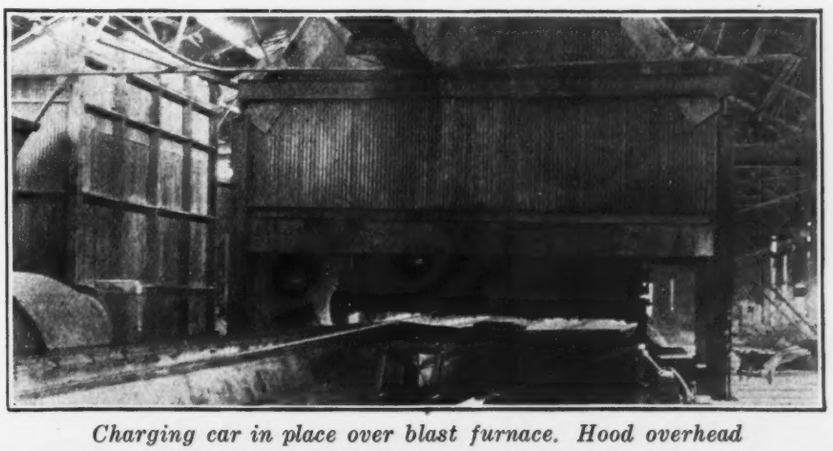
A proper flue system is of importance in lead-smelting plants. There are two long flues at the Federal smelter, one of brick and one of steel, with a hopper bottom. From these the fume passes through woolen bags. The temperature of the gases going to the baghouse must, of course, be carefully watched, so recording thermometers are used. A new 450-ft. stack was built about a year ago by the Custodis company, at the base of which a hearth is pro-



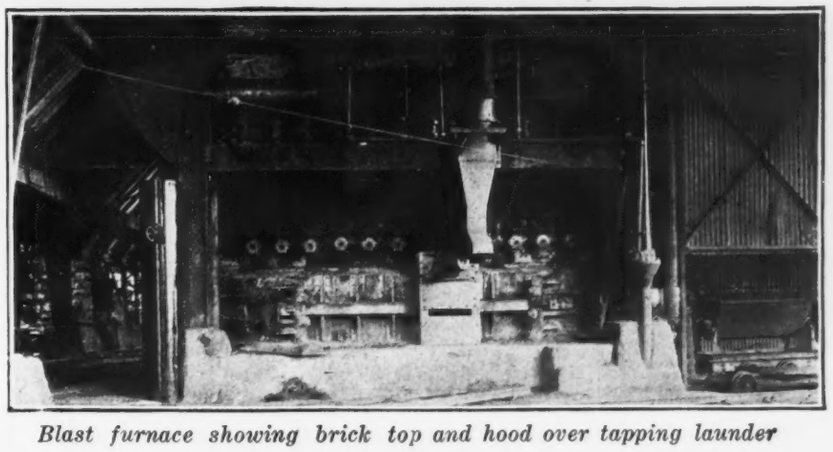
D. & L. sintering machine. St. Joseph Lead Co., Herculaneum, Mo.



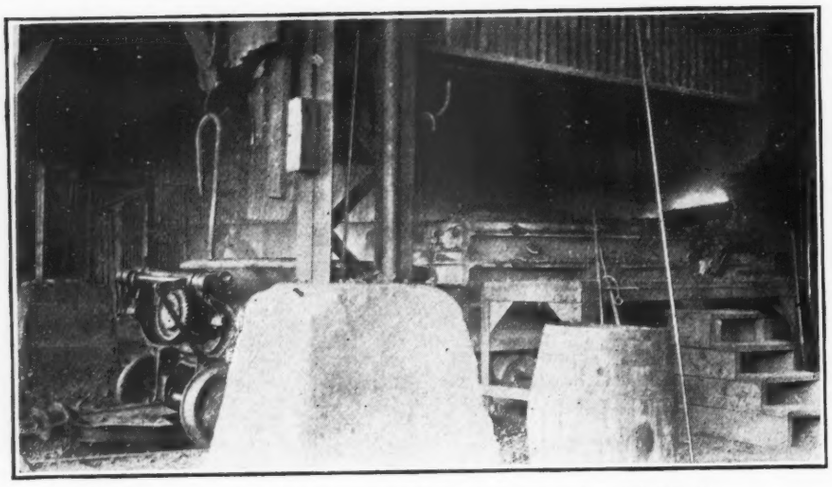
Brownhoist larry car for picking up blast-furnace charges



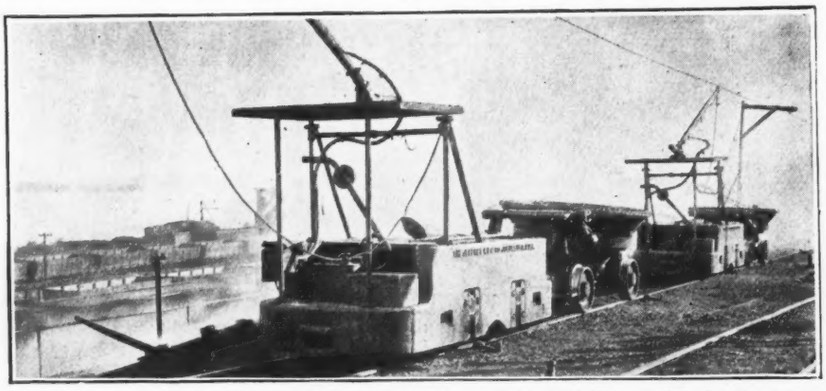
Charging car in place over blast furnace. Hood overhead



Blast furnace showing brick top and hood over tapping launder

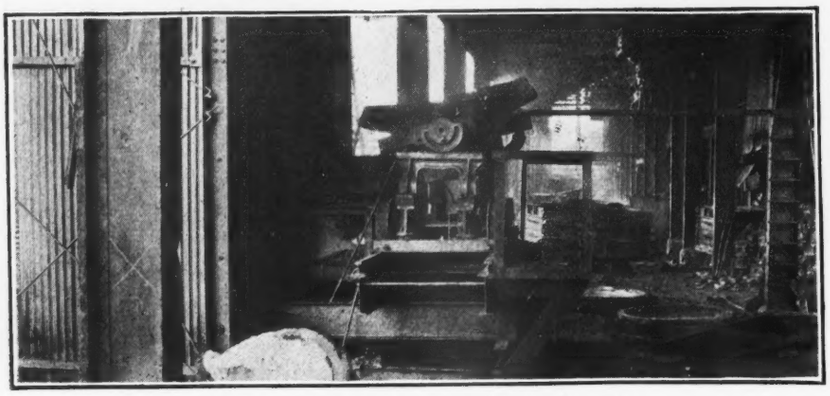


Forehearth for matte and slag, slag pot, and hood



Ready to granulate slag. Mississippi River and freight yard in background

Slag granulation, with attendant clouds of steam



New apparatus for granulating matte

vided to heat the gases, should that be necessary to make the smoke rise and diffuse in the air and thus prevent damage to the plant and animal life in the vicinity. The minimum temperature at the base of the stack is supposed to be 250 deg. F.

As a layer of dust accumulates in the flues, it is set on fire; it is burned in layers, making a friable sinter that is more easily removed. In recent years cadmium has been accumulating in the flue dust to such a degree that some method of disposing of it will have to be devised soon.

Most of the labor in the Federal plant is piecework, and negroes are in the majority. Doubling the capacity of the plant is expected to require only seventy-five additional men, so that the present high efficiency for which the general manager, Rudolph Porter, is responsible should be considerably increased. E. L. Ohnsorg is superintendent and J. J. Sullivan assistant superintendent.

At Herculaneum, Mo., on the Mississippi River about 30 miles south of St. Louis, is the smelter of the St. Joseph Lead Co., a modern and well-equipped plant under the charge of Charles M. Warner, C. W. Badgley being assistant superintendent. Here, sintering in Dwight & Lloyd machines, followed by blast-furnace smelting, is the method of reduction practiced for all varieties of concentrate; some Newnam ore hearths are installed, but none was in use at the time of my visit. Since then, I believe, some excess tonnage has been smelted in the hearths.

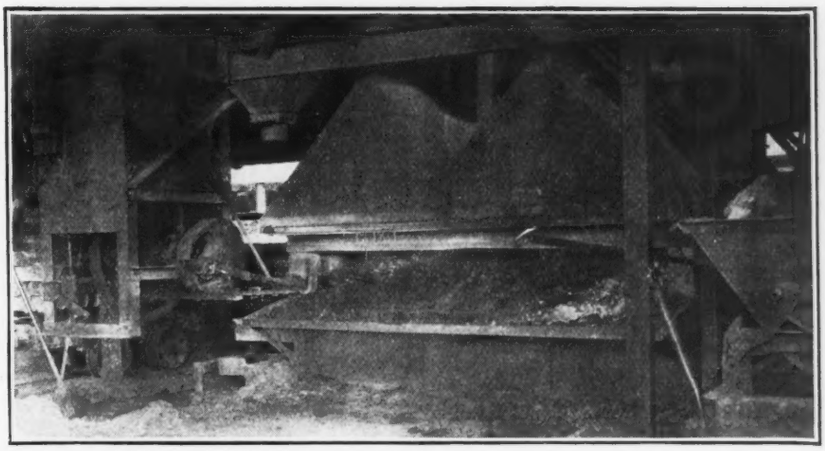
An elaborate conveying system takes the charges from the receiving bins, the proper weight of each material being withdrawn by short apron conveyors discharging on to the main belt conveyor. About two parts of table concentrate, containing 70 to 72 per cent of lead, is present, to one part of flotation concentrate, averaging about 60 per cent lead. The charge, as it is fed to the first four Dwight & Lloyd machines, contains about 8 per cent moisture and is roasted from 11½ per cent sulphur to 7½ per cent. The product is crushed directly in toothed rolls and carried by a steel conveyor to the next battery of eight Dwight & Lloyds, which reduce the sulphur content to about 3 per cent for blast-furnace smelting. The product of the second set of machines is screened, and about 15 per cent, the finest material, goes back to the

feed of the first four machines. About 850 tons of sinter a day is made on the twelve machines. The sinter averages about 50 per cent lead and is self-fluxing.

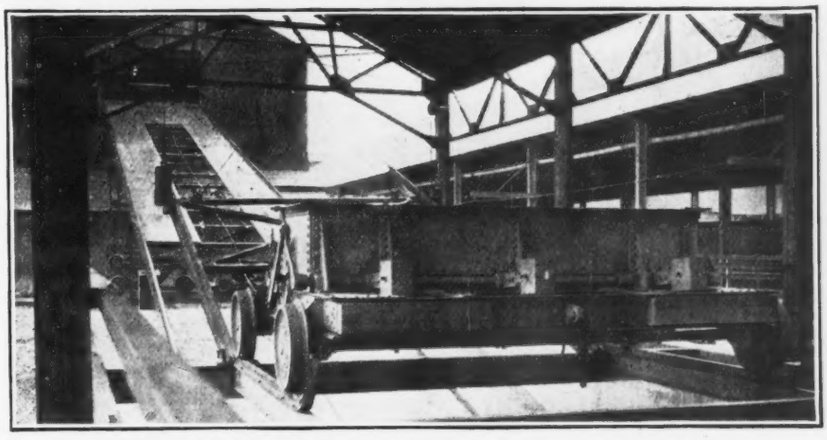
Some changes are being made by Mr. Warner in the design of the Dwight & Lloyds. The frame is being stiffened at the discharge end, as shown in one of the accompanying photographs; 60-lb. rails are being used for the track; and the framework is being made 5 in. wider to prevent the grief that is sometimes caused when the carriages supporting the grates project out a little farther than they are supposed to. Experiments are also under way with the combustion chamber. The aim is to get the oil flame to shoot down vertically on the ore bed and insure even ignition, a cast-iron water-cooled shell being used to confine the flame, with slots or holes directly over the ore bed. This will probably be further improved.

The sinter, after being wet and cooled, is discharged into standard dump-bottom cars and carried to bins, from under which a Brownhoist larry car picks up the charge for the blast furnaces. The weighing device and bin-operating mechanism is a built-in feature of the larry car, so that the motorman, at his seat, opens the bin gates, weighs out the desired amount, and passes to the next bin in a few seconds, as is done at the Midvale smelter, in Utah, where I believe the idea was first developed. The larry car discharges into a pit where a charge car is spotted. This is then hoisted up an incline and discharges into the blast furnaces, hoods being provided overhead to carry off the gas. When I was there, two furnaces were in operation and two were held in reserve.

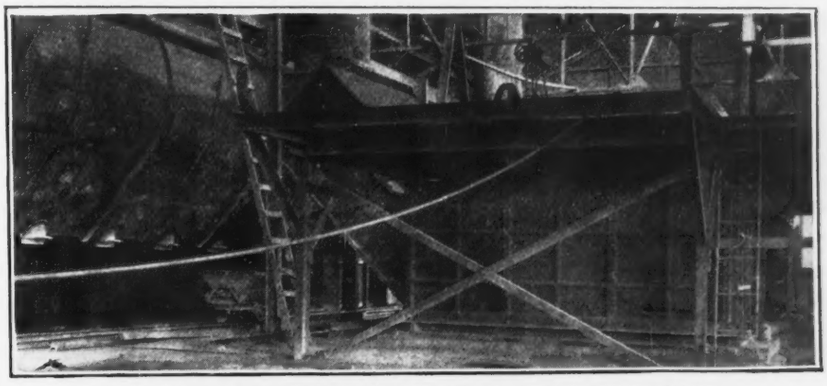
The air blast is at a pressure of about 28 oz. The lead tap is at the side of the furnace, and the slag and matte run out at the end into forehearths mounted on wheels, from which matte and some lead is tapped at intervals. The pots of slag, as they accumulate, are hauled up an incline with electric locomotives and the pots are then tapped into a stream of water, thus granulating the slag. This has a market, at 10c. per ton, as railroad ballast; otherwise it would merely be poured on the dump. Clouds of steam, of course, arise, some idea of which can be seen from an accompanying photograph; the operation is entirely



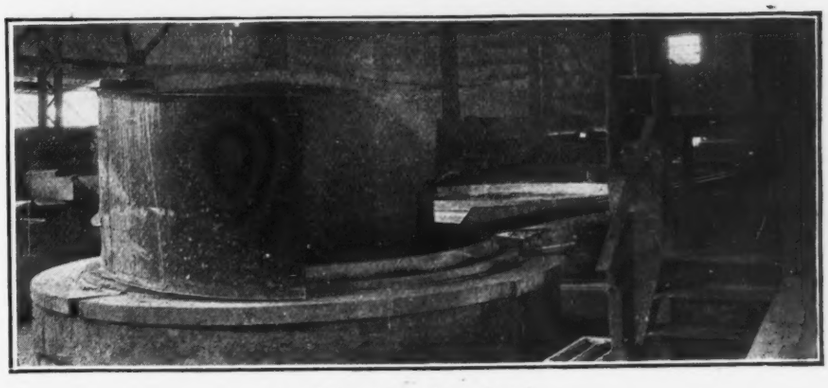
Newnam ore hearth and rabbling mechanism, St. Louis S. & R. Works



Spare blast furnace charge car kept at foot of incline to furnaces



Top of lead blast furnaces, showing flue connections



Lead desilverizing kettle

in the open air, so no discomfort is caused. The skulls run about 4 per cent in lead, so are resmelted. The matte is also granulated by a new arrangement, as shown in the photograph, the matte ladle being gradually tilted into a small pot which overflows into a stream of water.

The blast-furnace slag assays about as follows: Pb, 1 per cent; Zn, 10; FeO, 39; SiO_2, 25; CaO, 10; and MgO, 5 per cent.

The pots of lead are skimmed of copper dross and poured into kettles, where the lead is blown with air until it is almost solidified, then skimmed. The lead is then heated up and cast as St. Joe chemical lead. It contains about 4 oz. of silver per ton, and the copper content varies from about 0.06 to 0.07 per cent. The ordinary form of press is used for the dross, whereas at Federal the dross is removed and the lead separated entirely by hand. To meet a demand for desilverized lead, about 1,500 of the total production of 7,500 or 8,000 tons is further treated by the regular Parkes process, the silver recovered just about paying for the additional treatment.

In the reverberatory furnace used for the Parkes process, standard 9-in. soapstone brick are inset along the wash line, these being impervious to the metallic oxides which cause silica brick to corrode so quickly. The bricks are made by sawing up slabs of soapstone.

The baghouse contains the usual woolen bags, and the dust is burned in layers, as at Federal. It is removed from the flue by a drag scraper hauled out by a cable attached to an electric motor. The temperature has to be watched closely because of the presence of free sulphur in the dust.

The Herculaneum smelter is well maintained; a new bathhouse and a restaurant for employees had recently been completed when I was there. Much attention has been paid to keeping the employees free from lead poisoning and to proper fume removal.

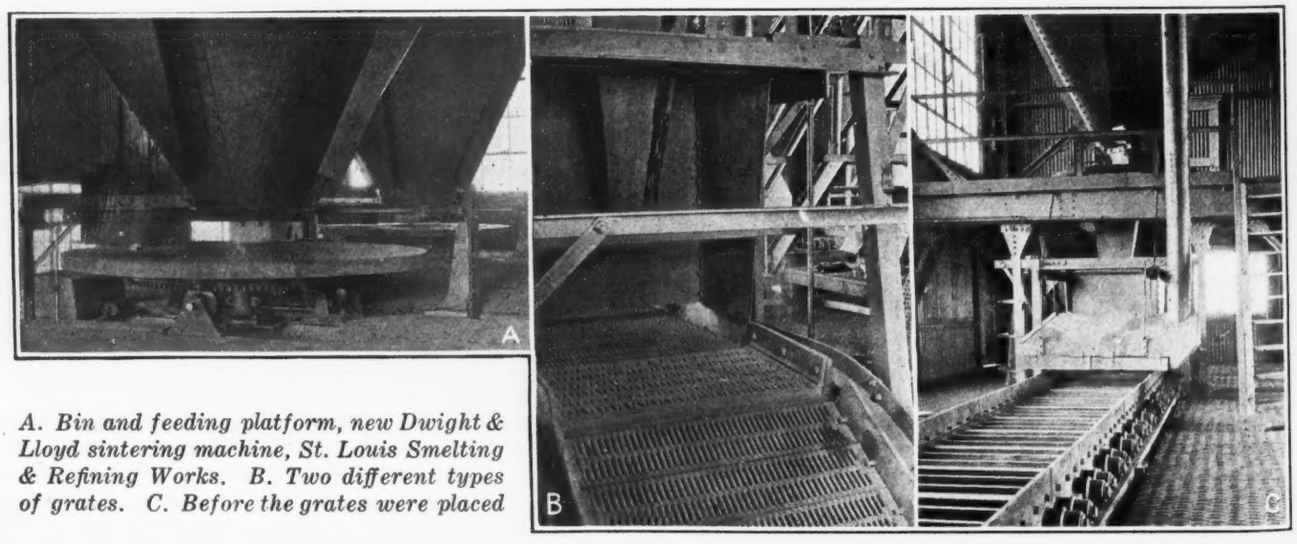
The St. Louis Smelting & Refining Works of the National Lead Co. has both ore hearths and blast furnaces, though the two furnaces were shut down at the time I saw the plant. W. E. Newnam is the manager of this plant, and in addition to his ability as an executive he is a mechanical genius. Possibly he is best known for his improvement of the old Scotch hearth, known as the Newnam hearth, which has entirely displaced the former type in this country and has also been largely adopted abroad. Each hearth can smelt twenty-four tons of charge in twenty-four hours; of this, eighteen tons is concentrate, and twelve tons of lead is produced. About 6 per cent of coke is used. The hearths are only satisfactory where the silica does not exceed 2 per cent; oxidized material works excellently. One of the most important features is the new type of hood, which completely handles all fume and smoke and cuts down the heat to a comfortable working condition. As will be seen in the photograph, the shovel is supported on a chain, the upper end of which is attached to a small trolley running the full length of the hearth, thus making its manipulation easier. Also, the remains of some small chains hanging from the hood can be seen. A curtain of these was used to protect the operators from the heat of the hearth, but the chain shovel makes this no longer necessary. The mechanically operated rabble, as is generally known, passes down the length of the hearth, rabbling the charge as it goes, and then returns to its initial position automatically.

A new Dwight & Lloyd sintering plant, with three machines, had just been installed when I was there, and Mr. Newnam tells me that it was put into operation the first of the year, treating flotation concentrate only. This had all been sent to the Federal smelter previously. He says, "The plant has lived up to our expectations in every way and started off with very little trouble. The entire operation from feeder bins to the delivery of the finished product into the sinter storage bins is easily handled by five men per shift. The sinter carries about 2½ per cent sulphur, which is as low as we wish to have it when it is smelted along with the gray slag from the hearths."

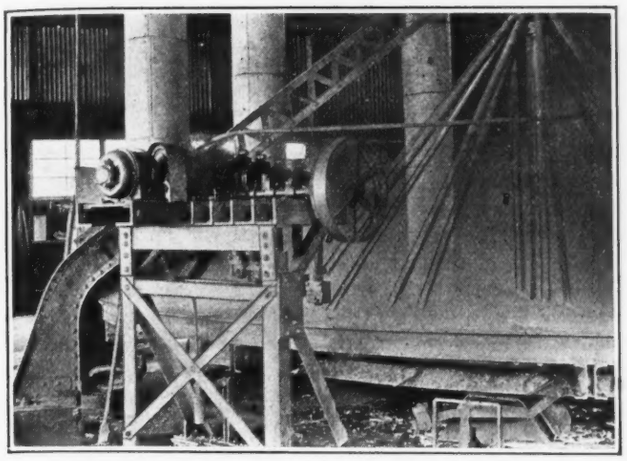
The ore is removed from the bins to weighing hoppers and the sinter by steel apron feeders to weighing hoppers. These hoppers discharge into a larry car which conveys the charge to a pit, where the material is dropped into a charge car. The charge is pulled up an incline to the blast furnaces, as shown in the illustration. A spare car is kept on an auxiliary track just above the loading pit.

Lead is desilverized by the Parkes process; the silver recovered, plus the bonus which the superior grade of lead commands, just a little more than pays the cost.

Mr. Newnam's latest invention is a decided improvement in the casting, handling, and loading of pig lead, which will no doubt be widely adopted by other lead smelters when its merits become known. I referred



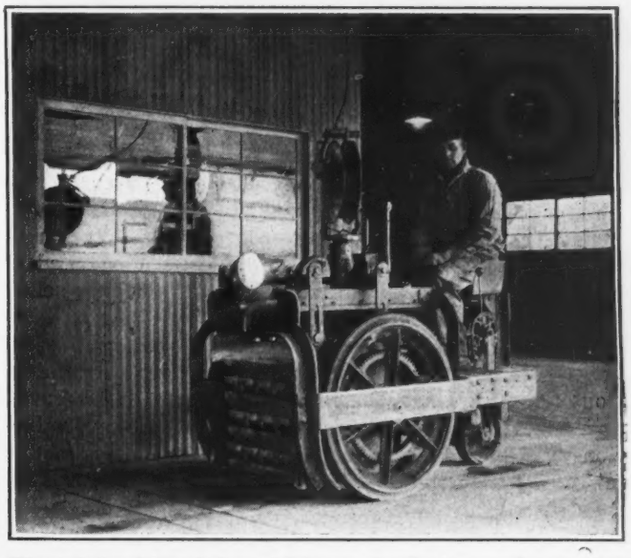
A. Bin and feeding platform, new Dwight & Lloyd sintering machine, St. Louis Smelting & Refining Works. B. Two different types of grates. C. Before the grates were placed



Casting wheel and automatic device for stamping pigs

briefly to this on page 111 of *Mining Journal-Press* of Jan. 19. The accompanying photographs will help to give an idea of the way things are now done at Collinsville. The casting wheel operates on ball bearings at both the bottom and top and the tripod is designed much stronger than usual. The molds are filled in the usual way, being brushed twice a day with a little fuel oil to prevent sticking. This has proved much better than a lime wash. The pigs are cooled with a spray of water, under a hood to remove the steam, and then pass under a machine, shown in the first photograph, which stamps the lot number on each pig. Five pigs are stamped while the wheel stands still, the operation being entirely automatic, and the power supplied by a small motor for that purpose alone. The wheel then passes along 60 or 70 deg. further and comes opposite to the compressed-air device shown in the second photograph. The operator swings the machine 2 or 3 ft. back and forth by hand, and turns on and releases the air. This is all he has to do. Each of the little hammers shown in the cut is provided with sharp prongs, which dig into the pigs as the piston is lowered. The piston is then raised, the five pigs are picked up, swung to one side, and lowered to the floor, where they are piled neatly. When the proper number of pigs has accumulated—I believe it is forty—the electric truck shown in the third photograph comes along, runs over the pile, lifts it vertically by the lugs on the bottom layer of pigs, and carries its load by way of the scales, directly into the railroad car, where the lead is dropped, perfectly piled, and with no chance of a mistake in the count. The electric truck is supplied with power from an overhead line connected by a spring-wound cable. The truck can turn quickly in any direction and travels

Compressed-air lift for removing pigs from molds



Electric lead truck for picking up lead pigs, and carrying them over scales to the cars

faster than a man walks. This truck was developed in principle at Omaha as a hand-operated truck by Mr. Newnam when superintendent of that plant, and was later electrified by Adolph Thiele, but the present model is an improvement, with merely a straight lifting action on the pigs and the driver seated behind the load. The entire equipment has a capacity of forty tons an hour, from furnace to cars, and requires four men for its operation, where formerly eight were necessary.

At the Collinsville plant, paint pigments are also made, but this comes without the scope of this article, though the process is an interesting one.

Those familiar with ordinary lead smelting will have observed that the practice on the Missouri concentrates has some points of difference with that commonly followed. It is perhaps a simpler and less costly operation, owing to the high grade and purity of the material received. A fair estimate of the smelting cost would be about $10 to $12 per ton of concentrate, in all probability. All three smelters are modern and interesting plants to visit. Furthermore, they are particularly well managed; and the hospitality of those in charge is hereby acknowledged.

Taxation of Mines in Arizona

By T. A. Rickard

THE TAX GATHERERS of the various states, and those of the Federal Government itself, have found difficulty in devising a method of taxation for mines that is equitable to all concerned. The difficulty is not due entirely to the vagaries of ore deposition. The gentlemen of the Bureau of Internal Revenue have not hesitated to avail themselves of the advice of such members of the mining profession as have had particular experience in these matters, and for that reason several notable improvements have been made in the regulations applicable to the federal taxation of mines. Some of the state tax commissions likewise have sought the advice of mining engineers especially versed in the subject of mine valuation. Among those so consulted the names of J. R. Finlay, L. C. Graton, R. C. Allen, and W. O. Hotchkiss come readily to mind. Several states are still having trouble in adjusting the irregularities of tax incidence, notably Arizona, which is the chief copper-producing region in the United States.

Arizona was admitted into the Union in 1912, at which time a Tax Commission, of three members, was created by legislative enactment. The new state insisted that the valuation of property for taxation be placed on a 100 per cent basis—that is, it demanded an appraisal as between a willing buyer and a willing seller. At the outset an earnest effort was made to avoid the difficulties inherent in any attempt to determine the present value of a mine by means of an expert examination of the workings, the calculation of the ore reserves, and an estimate of future prospects; therefore valuation at first was based upon the annual yield of the mine. In the report of the Tax Commission for 1917 it is stated:

"The greatest achievement of the Tax Commission has been the successful solving of the great mine-tax problem. For the last twenty years the question of mine taxation has been puzzling county assessors and boards of equalization, as well as the Legislature itself. In 1907 the Territorial Legislature enacted what was known as the Bullion Tax Law. This law was founded on the principle of valuing a producing mine for taxation purposes for an amount equal to 25 per cent of its gross output annually. Under this law all the producing mines in the state were valued at something like $20,000,000. This law remained in effect until 1912, being repealed by the Legislature that year. In 1913 the Legislature enacted a special mine-tax law based on the principle of valuing a mine for taxation purposes for an amount equal to four times the net proceeds plus 12½ per cent of the gross output annually. Under this law all the producing mines of the state were valued at approximately $110,000,000. Under the method adopted by the Tax Commission, all of the producing mines in the state were valued at approximately $172,000,000 for the 1916 assessment. This valuation does not include mining machinery, smelteries, nor improvements on mining property, which amount to nearly $39,000,000."

Here I may add that the valuation of mines in 1918 reached $416,080,482, or 267 per cent higher than in 1913. The present method (adopted in 1915), in which the Tax Commission expressed such pride, is valuation by averaging the net income for the preceding five years and capitalizing that average income at different rates, ranging from 15 per cent to 30 per cent, according to the character of the mine. Thus if a mine has made an average net profit of $1,000,000 per annum for the five years, and if it belongs to the 15 per cent class, which includes the steady long-lived mines, its capital value for taxation will be $1,000,000 multiplied by 100 and divided by 15, which gives $6,666,666. To differentiate between the varying physical conditions of the mines, as such conditions affect their earning power and their length of life, it was provided that they be divided into ten classes, each of which is subdivided into four. In arriving at the net income, no allowance is made for mine depletion, interest charges, new construction, or depreciation on personal property. This method, as is obvious, departed from the former crude schemes of basing valuation on gross output, but the attempt to avoid the physical examination of mines and the appraisal of their probable resources was frustrated by introducing the rate factor, because that was made dependent on the character of the mine—that is, its capacity to continue productive. The attempt of the Tax Commissioners to shy from the difficulties of mine examination has proved futile.

The system seemed to be working smoothly, and for the benefit of the state, as viewed by the Tax Commissioners, until in 1921 the temporary cessation of operations at the principal copper mines, except the Miami, placed the tax gatherers in a quandary. In assessing the tax for 1922 it would have been normal and proper to omit 1916, which was outside the five-year period, and, of course, to include 1921, the year of inactivity, even if it had the effect of decreasing the assessment. The Tax Commissioners did not pursue this logical course; on the contrary, they chose, arbitrarily, so it seems, to include 1916, a year of maximum net income at many of the copper mines; and for 1921 they used a fraction that represented the ratio of the 1921 production (not income) to the average production during the previous five years, the result being a devisor that was five plus the fraction thus obtained, thereby giving an entirely fictitious earning for 1921 and exaggerating the taxable valuation by 20 to 30 per cent. Thus the Tax Commissioners departed from the method they had established, and in which they had expressed pride; they discarded logical procedure and substituted caprice. By this lack of method one mine that actually had suffered a loss in 1921, owing to its being shut down for nine months, was credited with a taxable net income of $5,000,000, although for 1920 the commission had been satisfied with a net income from this mine of $2,400,000, and for 1919 had assessed the income at $2,800,000. Evidently the assessments of the commission had become capricious and incalculable. Several protests ensued, of course, and threats of litigation. A year later, in making the assessment for 1922, the commissioners decided to extend the averaging period from five years to ten, progressively, by adding a year at each assessment until the decade was complete, and thereby retaining 1916 (a year of unusually large income for most of the copper mines) for five years more

than was proper to their own method of estimating the capitalization for purposes of taxation. Moreover, the incorrect weighting of 1921, the year of curtailed output, was to continue to be a factor until 1930. This departure from their method reduced it to a mere vagary. Such is the condition of affairs at the present time.

In 1912 the taxable valuation of property in the state was $140,000,000, of which the mines represented 32.7 per cent; in 1913 the total valuation rose to $375,000,000, of which the mines represented 37.2 per cent. By reason of the stimulation of production at high prices during the war period, the taxable value of the mines increased progressively to $496,000,000 in 1919, when it represented 57.66 per cent of the total valuation of all taxable property. It is only fair to add that a reduction in taxes has followed the decline in profits earned since the hysteric period of the war. In 1920 the capitalization of the mines for taxation was $469,000,000; in 1923 it was $323,000,000. In 1912 the gross metal production of Arizona was $67,000,000, when the taxes collected from the mines aggregated $2,064,000, or 3.08 per cent of the gross; in 1917 the gross output was $209,000,000, and the taxes were $5,862,000, or 2.8 per cent of the gross; in 1921 the gross output was $29,000,000, and the taxes were $7,100,000, or 24.2 per cent of the gross. The census reports of 1920 show that the valuation of mines in Arizona in that year represented 422 per cent of the gross mineral production, whereas the valuation of farm lands was only 231 per cent of the total value of farm products in that year, and the valuation of cattle represented 226 per cent of the total sales of cattle and their byproducts. These three items represented 69 per cent of the total valuation of property in the state, which, by the way, has a population of 334,000, of which 33,000 is Indian. At the present time 46.5 per cent of the value of all taxable property in Arizona is represented by the mines of the state. Here we encounter one of the factors inimical to fair taxation. The feeling exists, and it is shared apparently by those in control of the tax gathering, that the farmer is a fixture, he is a permanent resident, he creates agricultural wealth by his labor and by the judicious use of capital in irrigation, and so forth; in short, he deserves considerate treatment. On the other hand, the mining company consists largely of absentee owners; it depletes the natural resources of the state, instead of creating new wealth; its property will not be taxable for long, and therefore must be taxed to the limit while the opportunity exists. This muddled thought on the subject persists. An effort is made to exaggerate the profits of mining and to minimize the farmer's earnings, so as to shift the burden of taxation. As one rancher exclaimed, "The copper industry must pay so much of our taxes—say 50 per cent—and that's all there's to it!" While at Phœnix recently I saw on the front page of the morning newspaper a heading that read as follows: "Arizona Ores of Gold and Silver Show Huge Values." It appeared that the output of gold in Arizona last year was $6,049,700; and of silver, $5,936,062. These were the "huge values." The proprietor of the paper, who is heavily interested in farm lands, did not mention the fact that the output of hay in Arizona last year was $9,000,000, and of cotton, $14,000,000.

The mine owners and mining companies are partly responsible for the adverse state of public opinion. They have acted unwisely in several respects. At one time—in the closing years of the nineteenth century—the taxation of mines was, as viewed today, ludicrously small. In 1901 and 1902 suits were brought by the Territory of Arizona against the owners of the United Verde and the Copper Queen mines for refusal to pay taxes, which were relatively low. The owner of the United Verde—W. A. Clark—had the good sense to settle his case out of court, but the Phelps-Dodge company, owning the Copper Queen, went through the courts, and lost, and in the course of the litigation exposed the fact that their mine was undertaxed, thereby giving ammunition to radical reformers. Later, in 1909, the successful development of the Ray, and the publication of high estimates of value, reopened the subject for public discussion; it attracted attention to the rapid creation of enormous ore reserves, and thereby gave a new slant to mine taxation.

Unfortunately, the mine owners, whether persons or companies, exhibit a lack of solidarity; they do not co-operate for the purpose of insuring themselves just taxation. The reason for this lies largely in the different circumstances under which they operate, the variety of ore deposits, the dissimilar physical conditions of their mines, the varying degree of the control they exercise over the policy that steers their enterprises, and their difference of attitude toward the stock market. This gives a decided advantage to the Tax Commission, which acts as a unit. It is unlikely that the mine owners could agree on any one method of capitalization, but at least they should support each other in any legitimate effort to correct the vagaries of annual assessment. Two safeguards are left to them, in case of inequitable treatment; an appeal to the public's sense of fair play, and, as a last resort, the Federal Court, for most of the companies are registered outside Arizona. Theoretically, an appeal can be made from the Tax Commission to the Board of Equalization, but unfortunately such an appeal from Peter to Paul is abortive, because the board consists of the very gentlemen that constitute the commission.

Another factor, adverse to what one may regard as the proper valuation of mines, is the inflation of the value of mining property by the stock market. The Tax Commissioners have used the quotations of the Exchange and the Curb, in New York and elsewhere, not only as a means of checking their own rough appraisals, but also as an indicator of the extent to which they might go in their assessments. They take the quotations on the first and fifteenth days of each month, and average these for the year, thereby obtaining something to compare with the results of their own method of capitalization. This, of course, is misleading, because some mines are run for stock-market purposes, and others are worked as private property, not to be used as a lure for the unwary. To a mining engineer it seems absurd to regard the stock market as a safe guide, because most of us are well aware that the share quotation usually represents an exaggerated valuation; it represents dealings in only a small part of the stock of a company; one might sell a few hundred shares perhaps without depressing the quotation, but an attempt to sell a few thousand shares would have an immediately unfavorable effect in most cases, and any attempt to dispose of a large fraction of the share capital of the company on the open market would cause a severe slump, to probably something like the real present value of the property. Incidentally, note may be made of the fact that the control of a mining prop-

erty is rarely made without advice from a competent mining engineer. It is by means of the exaggerated value of mines as expressed by the share market that much of the money made in the so-called mining game has been won; it is by the selling of over-priced shares by the few on the inside to the many of the public on the outside that fortunes have been gathered; indeed, one can say confidently that the overvaluation of the rich mines of the world, by means of stock quotations, has entailed more loss to the public than all the fakes and frauds that ever were perpetrated.

Persons unfamiliar with the technique of mining, even if they live in a mining district, are inclined to make fun of the discrepancies between the valuations of mines based upon the reports of mining engineers and the valuations expressed by the stock market. The gentlemen of the Arizona Tax Commission are not different from others unversed in such technical matters; and yet to their methods of tax valuation they have attached a factor that is linked to the estimation of the life of the mine and to an appraisal that can be made only by a competent engineer. The rate factor, from 15 per cent upward, but usually not far from 15 per cent, is used in a rough and ready way, without much appreciation of its real meaning. At 15 per cent, allowing 4 per cent compounded for amortization of the principal, the mining operation is a losing one until the seventh year. Even in the tenth year, the annual return is only 6.7 per cent, whereas with a life infinitely prolonged the redemption factor disappears, of course, leaving 15 per cent clear. At 20 per cent, with the same provision for amortization, the first return is obtained in 4.6 years; at 25 per cent, in 3.8 years; and at 30 per cent, in 3.2 years. At 12 years, the 15 per cent rate gives a yield of 8.4 per cent; the 20 per cent rate gives 13.1 per cent; the 25 per cent rate gives 18.2 per cent; and the 30 per cent rate, 23.1 per cent.

As a matter of fact it is difficult to get tax-gatherers to appreciate two features that are inherent in mining and that must be recognized in any reasonable scheme of valuation—namely, that in dealing with mines we are dealing not only with an exhaustible asset, but one the exploitation of which is attended with a large element of risk, to compensate for which it is imperative, if the speculation is to have a chance of being profitable, that the opportunity of gain be commensurate. It is fair to say that the tax gatherer is not remarkable in this respect, for the general public shares his disregard of the features that make mining on the one hand so hazardous and on the other hand so attractive to an adventurous spirit. Most shareholders regard their dividends as interest on capital, whereas, of course, until the principal has been redeemed, the dividends represent only the return of capital. Moreover, most buyers of mine shares buy them not for dividends—that is, not as an investment—but in the expectation of selling the shares at an enhanced price. To such speculations, or gambles, as some of them are, the accepted formulas for valuation do not apply.

One more result of the high assessment of property must be noted; namely, the inflation of values in the state. The system in vogue has led to the anticipation of large revenues and the pledging of them for public improvements, such as roads and schools, thereby promoting general extravagance. Of the state's revenue, 47 per cent goes to the schools and 23 per cent to roads and similar improvements, all of which are highly popular. The general result is to cause the owners of property and the state itself to borrow money on inflated valuations, the true nature of which will be disclosed inevitably in due course, as one or two recent bank failures suggest.

Make-believes have a way of coming home to roost, so it is not an unfriendly act to suggest to those in control of the affairs of Arizona that it behooves them to appraise mines and all other forms of property not only fairly but correctly, so that a reasonable thrift rather than a thoughtless extravagance may characterize the business of one of the most interesting and promising states in the Union.

Manganese Production in 1923

SHIPMENTS of high-grade manganese ore in the United States in 1923, according to preliminary figures compiled by the U. S. Geological Survey, were approximately 32,000 gross tons, valued at $894,000, or about $28 a ton, compared with 13,404 gross tons in 1922, valued at $455,160, or about $34 a ton. The decrease in average value appears due chiefly to the fact that of the high-grade ore shipped in 1923 a larger part than in 1922 contained only about 35 per cent of manganese, whereas most of that shipped in 1922 contained 45 to 53 per cent and therefore brought a higher price. Montana, as usual, shipped the largest quantity, about 22,000 tons.

The quarterly imports of manganese ore were as follows: first quarter, 17,445 tons; second quarter, 62,943 tons; third quarter, 82,025 tons; fourth quarter, 43,635 tons—a total of 206,048 tons, valued at $3,874,510, or an average of $18.80 a ton. These are the smallest imports made since 1911 and are less than half those made in 1918, when the domestic production was nearly ten times as much as in 1923. In 1918 the production plus the imports amounted to 797,000 gross tons, compared with 238,000 tons in 1923. These figures do not indicate a decrease in the requirements for manganese, however, for the production of steel ingots in 1923, according to the American Iron and Steel Institute, whose figures are compiled from reports made by the producers of more than 95 per cent of the output in 1922, was 43,226,955 gross tons, compared with an output of all steel in 1918 of 44,462,432 gross tons. The conditions thus shown are due to the facts that the imports of ferromanganese in 1923 were large and that manganese ore had been imported and stocked at the furnaces in 1922, prior to the date the new tariff went into effect.

The shipments of lower-grade ore in 1923 amounted to about 305,000 gross tons containing 10 to 35 per cent of manganese, valued at $1,110,000, and 855,000 tons containing 5 to 10 per cent of manganese, valued at $2,760,000. The apparent immense increase in the shipment of ore containing 5 to 10 per cent of manganese is due mainly to the fact that prior to 1923 the ore shipped from the Ottawa mine of the Montreal Mining Co., Wisconsin, was recorded as iron ore. The percentage of manganese in the ore shipped by this company has been increasing so much that in 1923 it became necessary to record these shipments as manganiferous iron ore, containing 5 to 10 per cent of manganese, instead of as iron ore, as had formerly been the practice.

Settlement at the Walker mine

Anaconda's Walker Mine and Mill

A Small but Unusually Well-Equipped Copper Property, in California, Using Shrinkage Stoping and Flotation Concentration

By George J. Young
Associate Editor

THE WALKER COPPER MINE is in Plumas County, Calif., 8.4 miles northeasterly from Spring Garden, which is on the line of the Western Pacific Railroad. It can be reached by wagon road from Portola, 22 miles, or from Gulling, 19 miles distant. From the latter point heavy freight is hauled to the mine. A wire-rope tramway connects the mine with Spring Garden. Over this, concentrates are transported to the railroad and supplies are brought to the mine. During the winter months the mine is cut off from road transportation by heavy snow. The only communication during winter is by way of the wire-rope tramway. The comparative isolation of the mine during part of the year has interposed conditions upon operation and living that are unusual in California. The surrounding region is mountainous and wooded.

Mining Conditions Favorable

The ore deposit is distinctly different from the Engels copper deposit, which is in the same region. The Walker deposit is typically a vein between fairly definite walls, it strikes N. 15 deg. W. and dips 60 to 65 deg. to the northeast. Both walls are gneiss. The ore consists of chalcopyrite associated with pyrite and pyrrhotite in a gangue of quartz. Accessory minerals are barite, garnet and magnetite. The vein is on the hanging-wall side of a granite gneiss contact and parallels the contact at a distance of several hundred feet. A small quartz stringer carrying chalcopyrite occurs at the contact. The wall rocks and ore are compact hard rocks that stand well in open stopes. Comparatively little water occurs in the fissure. The mining conditions are especially favorable. The proportion of ore and gangue varies, and bands of ore interlace the vein. The volume relation is 10 cu.ft. of ore in place to one ton. Gold and silver occur associated with the copper and are recovered in part. The recovery ratios, as figured from a statement of the content of a concentrate lot, approximate one ounce of silver to 52 lb. of copper and one ounce of gold to 2,081 lb. of copper. Gold and silver are recovered in the proportion of one ounce of gold to 39 oz. of silver. The average copper content of the ore ranges between three and five per cent, although in places the ore is much richer. The approximate gold and silver recovery is somewhat over a dollar per ton.

The orebody at present being worked is about 750 ft. long and varies in width from 15 to 50 ft. It extends above the adit level a vertical distance of 590 ft. to the third level. A considerable proportion of ore has been stoped above the third level. Several additional orebodies have been discovered but not worked. The mine is opened by an adit which is called the 700 level.

During the mine's early history the oreshoot now being mined was developed by two shafts at the top of the hill above the mine. The adit was driven from the mill site a distance of 5,200 ft. and connects with one of the shafts, of which both are used for ventila-

tion. This shaft is provided with a 60-hp. single-drum, electrically driven hoist at the third level and an auxiliary hoist at the surface, and is used for access to the workings above the adit level. The two levels contiguous to the adit level are 140 ft. apart, and the succeeding two levels 170 ft. apart. The orebody below the adit level has not been developed. Drifts are 5x7 ft. in section; the adit is 6x8 ft. in timbered sections, and the width of the vein along the length of the orebody. The shaft has three 4x5 ft. compartments, one of which is used as a manway and the others for hoisting. It is timbered with 10x10-in. sets, 6 ft. apart. The track gage used throughout the mine is 24 in. The track in the adit is 30-lb. rail.

Modified Method of Shrinkage Stoping

Shrinkage stoping is the mining method in use. The deposit is admirably suited to this method, as orebody and walls are hard and the footwall slope is steep. The method was applied in the usual way by stoping above a pillar left to protect the drift and extending the stope to within 25 ft. of the level above. The stopes were finished upon the upper levels and started sequentially on the lower levels. On the completion of the adit the method was modified as shown in Fig. 1. A sublevel was driven 35 ft. above the adit level, and 6x11-ft. ore chutes at 45-ft. intervals were raised on the footwall for a short distance. These branched into two 6x6-ft. raises that terminated in bulldozing chambers connected with the sublevel by short crosscuts. The top of each branch chute is closed by a grizzly

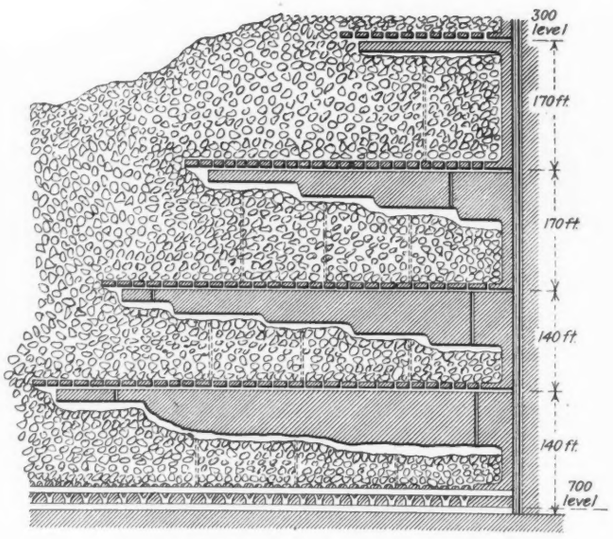


Fig. 2—Sketch showing method of mining pillars

upper levels is drawn from chutes and trammed to transfer chutes which extend to the adit level.

As the mining progresses and the upper stopes are completed the chutes are opened and the ore is allowed to run into the raises; the pillars above and below each level are broken down beginning at the end of the stope farthest from the shaft and retreating to the shaft. The floor pillar is first broken down under the protection of the roof pillar. The roof pillar is next shot down. The method is indicated by a sketch in Fig. 2. The result of this modification was to eliminate the handling by chutes and cars of practically two-thirds of the ore derived from the upper levels, as the broken ore in the stopes formed practically a continuous mass. The draw-off is restricted to the adit level, except for one-third of the ore, which is drawn off and transferred as the individual stopes are extended. Practically all of the bulldozing is confined to the sublevel. Such a procedure results in minimum cost, but might not be applicable to other mines—for instance, consisting of four 110-lb. rails, 8 ft. in length, spaced 1 ft. apart. Above the grizzlies short raises connect with the stope which is opened out above a pillar 6 to 8 ft. in thickness. The stope is continuous along the orebody. A pillar is left at the shaft. Ore from the

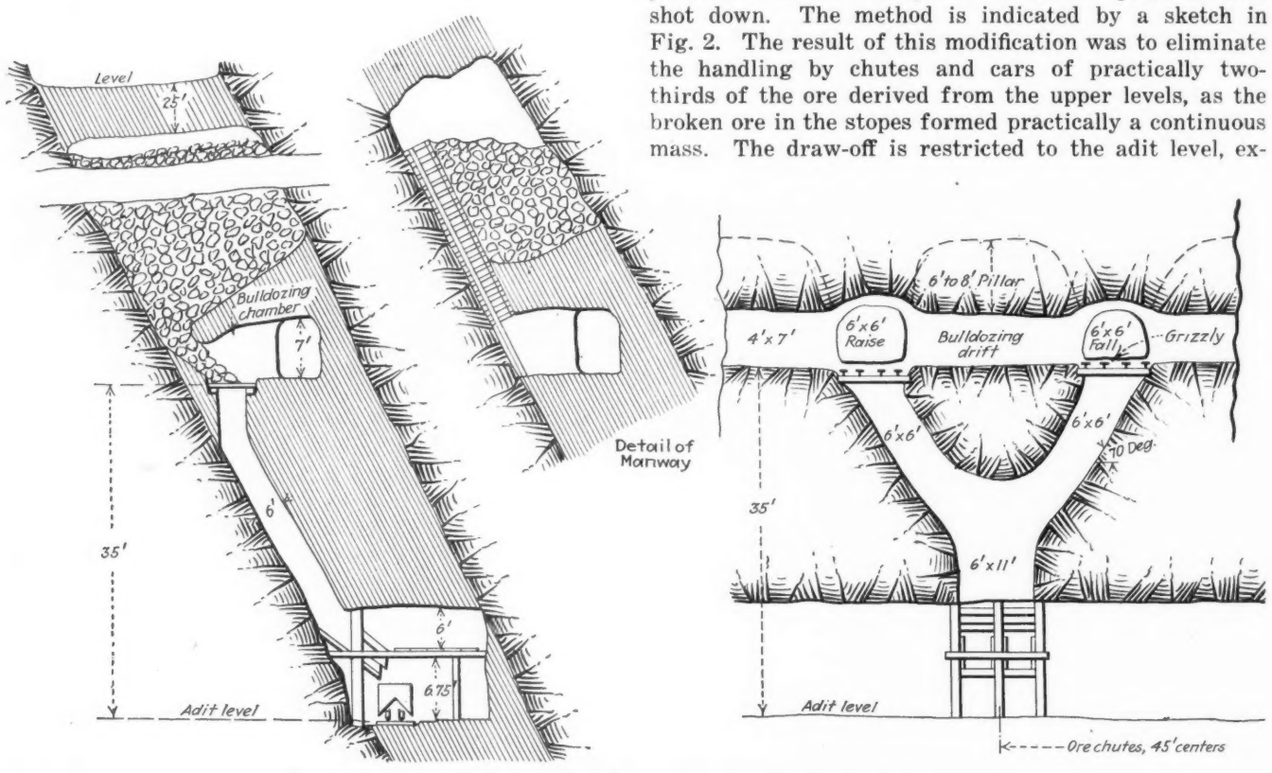


Fig. 1—Details of shrinkage-stope method of mining

stance where the grade of the orebody varied considerably. In this particular instance the conditions are especially favorable, and advantage has been taken of them.

Tugger Hoists Handle Steel

Manways are placed on the footwall and are 3x3 ft. in the clear, constructed of 6x6-in. timber cribbing. They are placed on the extreme ends of the orebody and 100 ft. apart between these limits. Alternate manways are provided with a tugger hoist for handling steel, and each is provided with a 1-in. water pipe, a 1.5-in. air pipe and a ladder. Ladders are constructed of 2x6-in. timber, rungs 2x4 in., inset 2 in., the clear width of the rung being 12 in. All ladders used throughout the mine are made to this standard. Steel is hoisted in a

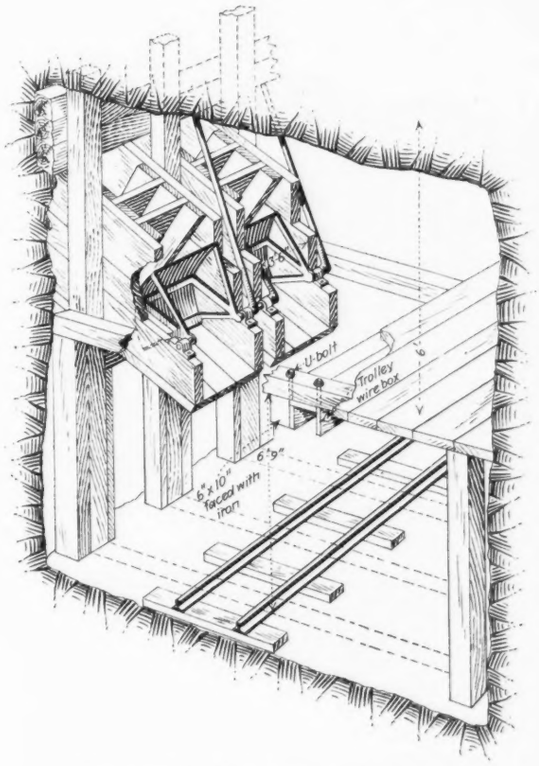
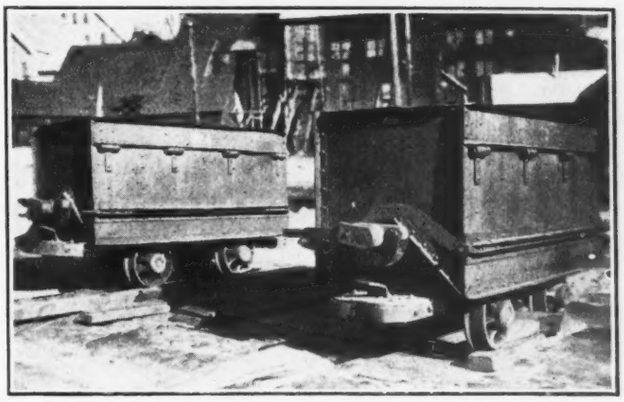


Fig. 3—Loading chutes at adit level

three-sided steel boat which operates between the side of the manway and the ladder.

Three types of drills are used, the 248 Leyner-Ingersoll, DDRW 13 Jackhamer, and the CCWH stoper. The Leyner-Ingersoll is used for raising, drifting and stoping and the Jackhamer for blockholing. Only occasional use is made of the stoper. One-inch hexagonal hollow steel is used for the Leyners and $\frac{7}{8}$-in. hexagon for the Jackhamers. Jackhamer steel only is collared. Tappets are used in the Leyners. Starting bits are $2\frac{3}{8}$ in., bit gages are reduced by $\frac{1}{8}$ in. steps, and drill changes are 12 in. A cross bit is used on starters and Carr bits on followers. A $1\frac{1}{4}$-in. Carr bit is used for blockholing. A $\frac{1}{2}$-in. water and a $\frac{3}{4}$-in. air hose, both 5-ply, are standard.

Drills are supported by a 4-in. column with a 3-ft. arm, giving a 7-ft. sweep for one set-up of the column in the stopes. Drill holes in stoping are either horizontal or at a low angle upward and are from 5 to 8 ft. in depth. The powder is $1\frac{1}{4}$ in., 40 and 60 per cent



Side-dump ore cars used in the haulage adit

gelatin; the caps are No. 8. No stemming is used. The 60 per cent gelatin is used for cut holes in drifting in tight ground. The 40 per cent is used in stoping. About eight times as much 40 per cent is used as the 60 per cent. Machines in the stopes average about 35 tons per shift. In drifting, 5 ft. of advance is made in two shifts in a 5x7-ft. drift. As an indication of the hardness of the ore, fifteen to seventeen Leyners in use, together with Jackhamers, require about 1,000 pieces of steel per day. About 3,500 tons is broken per week. One Jackhamer man is required for two to four stoping machines.

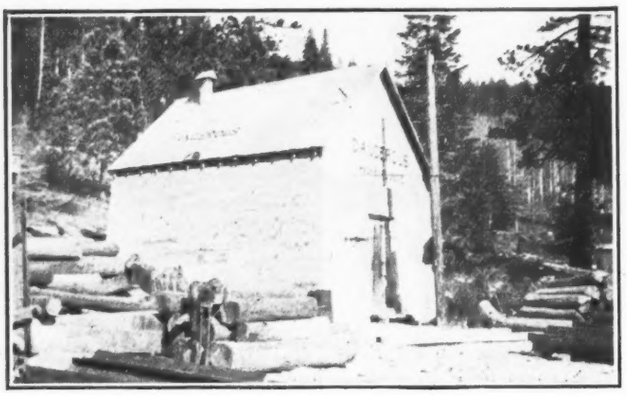
Transportation by Trolley Locomotives

All loading chutes are on the footwall side of the haulage drift. Each chute is 3.5 ft. wide in the clear. An arc gate and cross boards are used to control the ore stream. The chute angle is 41 deg. Chutes are constructed of 4-in. plank, the general features being shown in the sketch, Fig. 3. Used ball-mill liners are attached to the chutes to reduce wear. Cars are roller-bearing, gable-bottom, side-dump type, weighing 3,300 lb. and having a capacity of 2.75 tons of ore. They are hauled in trains of eight cars by an 8,400-lb. trolley locomotive. The over-all length of the car is 10 ft. A second locomotive is held in reserve. The ore is dumped upon an inclined grizzly and is received in a 1,600-ton circular steel bin 30 ft. in diameter. Oversize ore is broken by sledges at the grizzlies.

Four electrically driven compressors have been installed. One is a 1,760-cu.ft. Ingersoll-Rand, direct connected to a 250-hp. synchronous motor. The other three are each connected to a 100-hp. motor by short belt drive and each is 620 cu.ft. in capacity. Two air

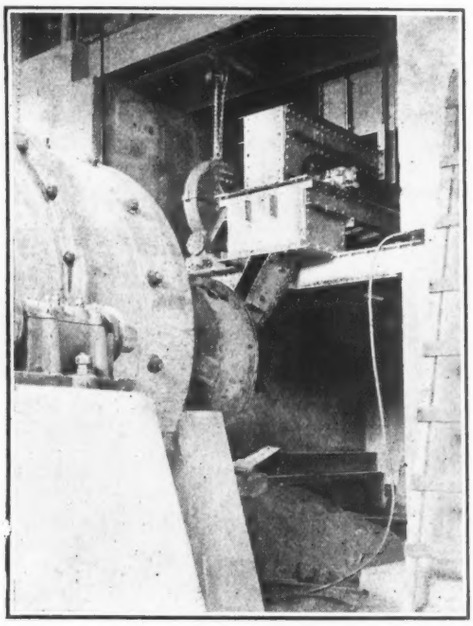
Cage for use in the inclined shaft

receivers connect with a 6-in. air main extending through the adit. A diamond-drill hole in the mine furnishes water for drinking and drilling. A small machine shop, drill and sharpening shop, equipped with



Concrete powder magazine

oil forges and machine sharpeners, a drill-repair shop, and a storehouse are provided close to the portal of the adit. A sawmill is available for the preparation of mine timbers from logs. The substation is at one end of the compressor house. This contains the main switchboard and three 600-kva., self-cooled, oil-insulated transformers that step down from 22,000 volts to 2,300 volts. The switchboard has an auxiliary bus for the compressor room. This provides for the four compressor motors and motor generator sets (75-hp. motor; 50-kw. generators; one a stand-by) supplying direct current to the trolley circuit. The high voltage lines are connected to three F.K. 24, G.E. automatic circuit breakers and oil switches set at 25,000 volts and 300 amperes. The switchboard in addition to the compressor-room circuit provides for the concentrator circuit, the crushing-plant circuit, and a miscellaneous circuit that supplies current to the tramway, to the mine, and for lighting. All panels are protected by time-limit overload relays. A graphic meter gives the total power input.



Apron feeder, feed spout, and end of the ball mill

A new flotation mill was being completed at the time I visited the mine. This will replace a 250-ton mill that has outlived its usefulness but which served the purpose of developing the milling method now in use. The flow sheet of the new mill is given in Fig. 4. The ore was for a time divided into first class and milling ores. The first class ore was shipped along with the concentrates to Tooele, Utah. In the new plant no attempt will be made to pick the ore, but waste will be removed at the belt conveyor leading to the interme-

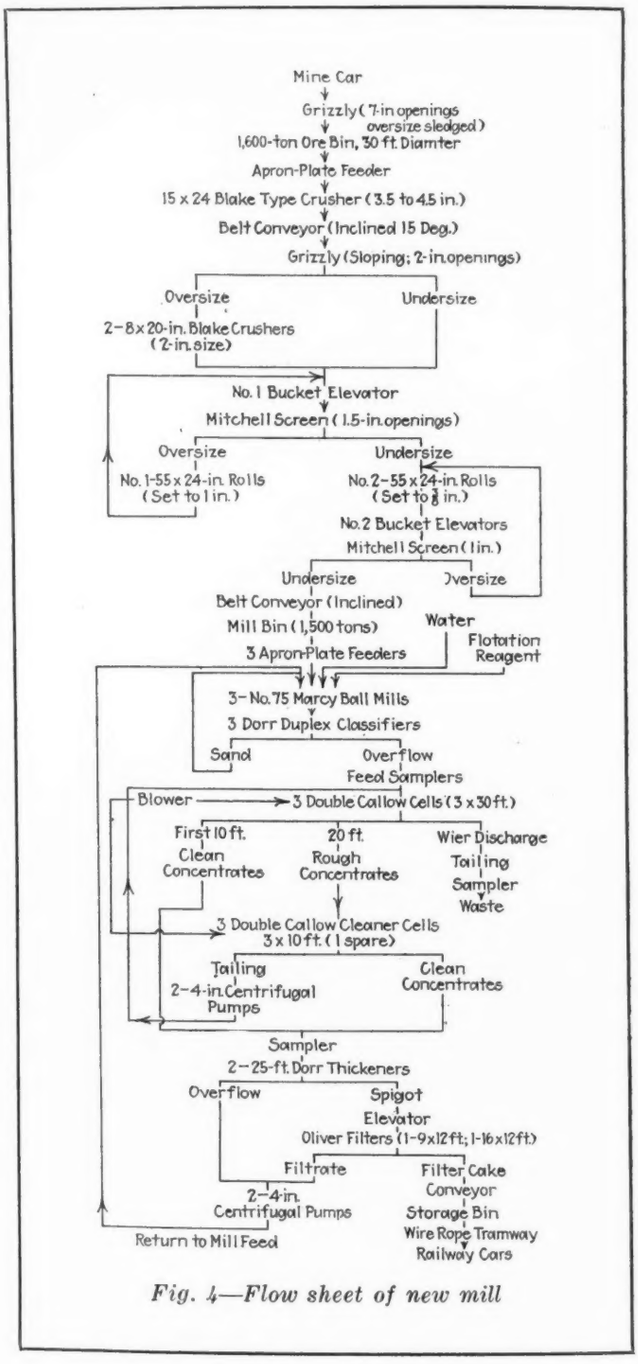


Fig. 4—Flow sheet of new mill

diate crushing plant. The ore consists of closely associated chalcopyrite and pyrite, together with accessory heavy minerals such as pyrrhotite and magnetite, in a quartz gangue in which barite occasionally occurs. The chalcopyrite and pyrite are in coarse irregular masses, sometimes of considerable size. The concentration ratio

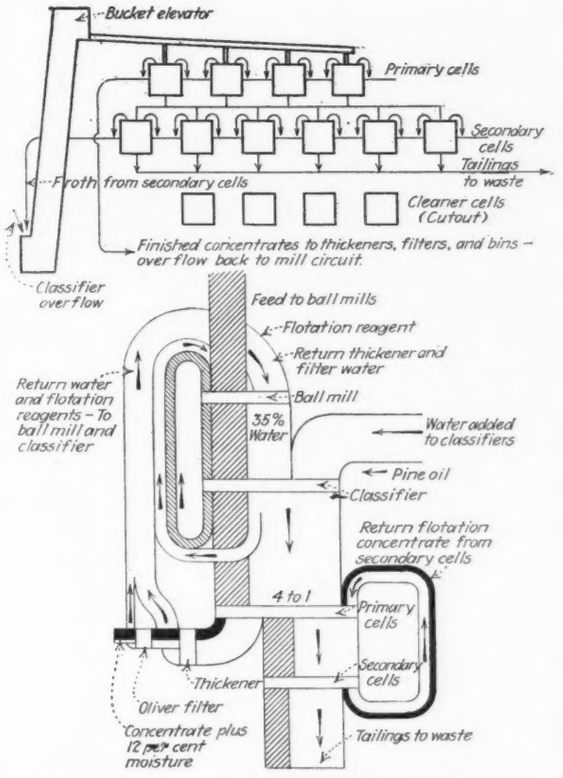


Fig. 5—Flow sheet of old mill

on ore containing 4 per cent copper is six to one, which indicates a comparatively high proportion of heavy minerals. Ore treatment necessitates the separation of the chalcopyrite from part of the pyrite in addition to its separation from the gangue minerals. This has been accomplished by flotation.

The limit size of grinding has been found to be 8 to 12 per cent on a 48-mesh screen, at which size 50 per cent of the ground ore will pass a 200-mesh screen. Present practice is to crush to about 3 to 6 per cent on 48-mesh screen. The operation of the Callow cells determines the degree of crushing. If they "mud up," finer grinding is required, and the ball mills are operated accordingly. The ball mills are operated at 35 per cent moisture in the discharge. The pulp ratio in flotation is four to one. The flotation reagents consist of a mixture of 2 lb. of thiocarbanalid and 15 lb. of lime added in the proportion of 1.2 lb. per ton of ore to the ball-mill feed, and 0.25 lb. pine oil per ton added to the classifier sands. The original practice was to use 2 to 3 bbl. of coal tar, in addition to pine oil, per day. The metallurgical results are excellent, the tailing averaging from 0.1 to 0.2 per cent copper. The concentrates contain 12 per cent moisture as loaded, and when they arrive at Tooele average from 8 to 9 per cent in summer.

Cleaner Cell Discarded in New Flow Sheet

Flotation in the old mill followed customary practice in that the primary Callow cells were used as roughers, the flotation product going to cleaner cells and the tailing to secondary cells, which also sent their flotation product to the cleaners. The tailing from the cleaners was sent to the primary circuit. This was advantageously modified by using the primary cells for a finished concentrate (the lip discharge is contracted to one-third of the normal length); the secondary cells serve to recover any concentrate left in the tailing. The cleaner cells were cut out. The arrangement is sketched in Fig. 5, which also shows the water-flow arrangements. The plan of treatment has worked out excellently and has resulted in simplifying the flow sheet.

In the new mill long flotation cells of the Callow type are provided. The primary cells are each equipped with ten 3-ft. square wind boxes, 2 in. deep, covered with stitched five-ply canvas. The cleaner cells are each equipped with three wind boxes of the same size. The canvas surface is divided by two strips placed longitudinally. The maximum air pressure will be 5 lb. per sq.in. and the air flow 10 cu.ft. of air per square foot of canvas. Air is supplied by two blowers of the Root type, each driven by a 150-hp. motor. Two smaller blowers, each driven by a 50-hp. motor, will be used for stand-by purposes.

The new mill provides for coarse and fine crushing to approximately $\frac{3}{8}$-in. size. As the ore is tough and hard and also free from clayey material, no special problems are involved in crushing, screening, or bin storage. No dust-catching appliances are provided, as the ore can be wet sufficiently to keep down any dust. Magnetic appliances are in use to catch tramp iron. The mill bin is constructed of steel beams, with an inner wooden lining on sides and bottom. The apron-plate feeders are driven by a worm gear and variable speed motor; they are placed beneath the ore bin and deliver by a spout to the feed ends of the ball mills. Each of the three ball mills is operated in closed circuit with a Dorr duplex classifier. The ball mills are driven by 150-hp. motors, which are connected by flexible couplings to the pinion shaft. Ball mills and motors are carried on concrete foundations extending above the mill floor. Each ball-mill drive is controlled by a push-button switch. An overhead crawl and chain block are available for handling heavy parts.

The primary Callow cells are at a lower level, and on a still lower level are the cleaner cells. The primary cells can be used as roughers or finishers and the clean-

Top of a cribbed manway entering a stope

ers as such, or as guards. The concentrate is laundered to thickeners and the thickened concentrate is lifted by a bucket elevator to Oliver filters. The overflow liquors are returned by pumps, as is also the flotation froth of the secondary cells. A belt feeder is used for the solid flotation agent and a wheel-type feeder for the pine oil. The flotation cells are constructed of redwood. The mill is arranged in three units, each of which can be operated independently and each of which has a capacity of 250 tons per day. The thickening and flotation division is arranged in two units. Thus, with the exception of the liquor returns and the bucket elevator used for lifting the thickened concentrate to the Oliver filters, the flow of products is by gravity.

Individual motor drives, except in the intermediate crushing division, are used throughout. Large motors are on 2,200-volt circuit and small motors are on 440-volt. A 200-kva. transformer in an underground vault steps the 2,200-volt current to 440 volts. The push-button control panel for the ball-mill motors is in a vault in the retaining wall below the ball-mill floor. Trumble safety switches are used on small motors up to 10 hp. These are in series with G.E. FP-10 oil circuit breakers. A compensating switch is used with overload and low-voltage release on larger motors, except those handled by the push-button panels.

The mill building is of steel-frame construction, with roof pitch one to one. The frame is covered with 1-in. boards nailed to 2x4 strips that are bolted to headers 4 ft. apart. The boards are placed vertically. Corrugated zinc sheets are nailed to the boards on sides and roof on the exposed side.

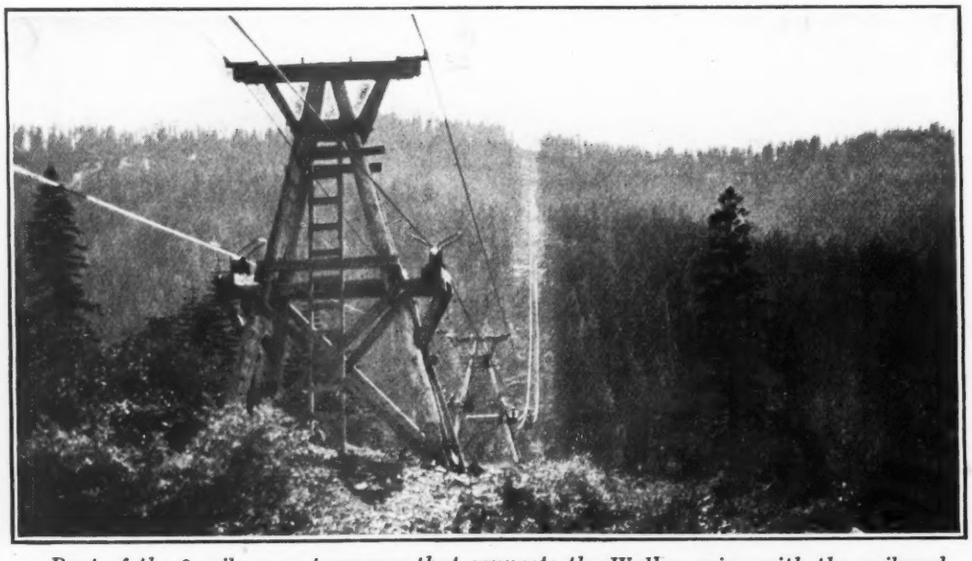
The wire-rope tramway constructed in 1919 and 1920 has 104 towers, eight tension stations, and two terminals. Its horizontal length is 8.4 miles. The elevation of the mill terminal is 6,100 ft.; that of the Spring Garden terminal 3,970 ft. The highest summit between terminals is 7,460 ft. The traction cable is 18 miles in length and is a ¾-in., 6x19 wire rope. The loaded track cable is 1⅛ in. in diameter, the empty track cable 1 in. in diameter. The buckets are spaced 1,000 ft. apart and carry 800 lb., at a speed of 425 ft. per minute. It requires 20 to 40 hp. for starting and 7 to 10 hp. for operation.

At the mine 125 men are employed, including blacksmiths, timber framers, miners, motor men, repair men, and compressor men. The mine is operated on a two-shift basis. The new mill will require twenty-one men for the three shifts. The crushing plant will be operated one shift per day and will require five men. A repair crew of from three to five men is maintained. Separate houses are provided for married men and two rooming houses for the single men.

The control of the property as a whole is in the hands of the Anaconda Copper Mining Co., through its subsidiary, the International Smelting Co. V. A. Hart is general manager; C. W. Page is mill superintendent; J. S. Finlay, general superintendent, and D. Mackenzie, master mechanic. H. N. Geisendorfer is mine foreman. F. C. Torkelson, of the Anaconda Copper Mining Co., superintended the construction of the milling plant, and Julius Kurtz, of the International Smelting Co., of Tooele, installed the electrical equipment. Acknowledgment is gladly made of the assistance of these men in obtaining information for the preparation of this article.

Favorable Prospecting Areas in Northwestern Quebec

A description of the geology of an area in northwestern Quebec including a part of Rouyn township and Dufresnoy and Destor townships is given in a preliminary statement recently issued by Dr. Robert Harvie. The area is considered favorable prospecting ground. These townships are underlain mainly by volcanic tuffs and basic and acid lavas of Keewatin age. Temiskaming conglomerate which in other places has been found to favor the deposition of gold from mineral-bearing solutions occurs in the extreme northwestern part of the area described. A mass of granite of later age is exposed in the vicinity of Dufault Lake and an intrusive body of syenite porphyry was observed a short distance south of the southern boundary of Dufresnoy.



Part of the 9-mile rope tramway that connects the Walker mine with the railroad

USEFUL OPERATING IDEAS

Drifting With Scraper Slides

By George C. Newton
Consulting Engineer, Mineral Mining Co., Iron Mountain, Mich.

THE MINERAL MINING CO. operates two adjoining properties, the Osana and the Wauseca mines, in the Iron River district, at present the northwesterly end of the Menominee range, Michigan. Most of the mining is now at moderate depth. The principal mining methods are sub-level stoping and top slicing, other methods, such as shrinkage stoping, being in use to a lesser extent. The iron ores produced are of non-bessemer grade, due to the high phosphorus content, but as they have good physical properties and are easily handled in the blast furnaces, they are in demand, particularly for the manufacture of foundry pig iron.

In January, 1923, a new level, the fifth, was opened at the Osana. All rock and ore broken in the development openings was loaded with drag-scraper equipment designed and built at the mine. A compact type of loading machine called the Osana loader[1] was developed. When the work was under consideration in the latter part of 1922, scraper equipment was in use to a considerable extent at many of the iron mines in the Lake Superior district. However, they were used largely for ore movement. At several of the mines scraper loading machines were in use, or being built, for loading rock and ore in drift work. The prevailing opinion was that scrapers were well adapted for mining work and sub-level openings where the ore was moved

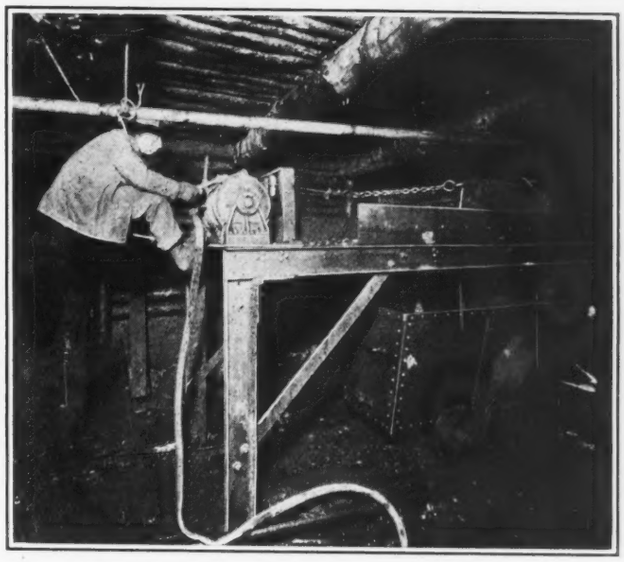


Fig. 2—Platform loader, discharge end

to raises, but for main level openings and for loading material into cars, the regular underground loaders of what might be termed the shovel type were considered to be better. However, as a result of observations, the method seemed to offer so much promise that it was decided to use equipment of this type for the fifth level work in the Osana.

The first machine built was similar to the platform loader used in the Michigan copper mines, a description of which was given by Ward Royce in the *Engineering and Mining Journal* of Dec. 10, 17, and 24, 1921. The machine was of steel construction, mounted on trucks and with swinging doors on the platform over the car. As nearly as possible, a self-contained and portable unit was constructed so as to permit of moving to a new location with the minimum time and work. The loader, Figs. 1, 2, and 3, consisted of a slide with low sides, carried on trucks, the platform extension being supported at the rear by two folding legs. The slide can be separated from the platform, although ordinarily it is moved with it, by running a car in under the platform and inserting a timber, the legs being folded up while the moving is being done. The scraper hoist, a Sullivan Turbinair, was mounted at the extreme rear, with the operator's seat directly behind and above the

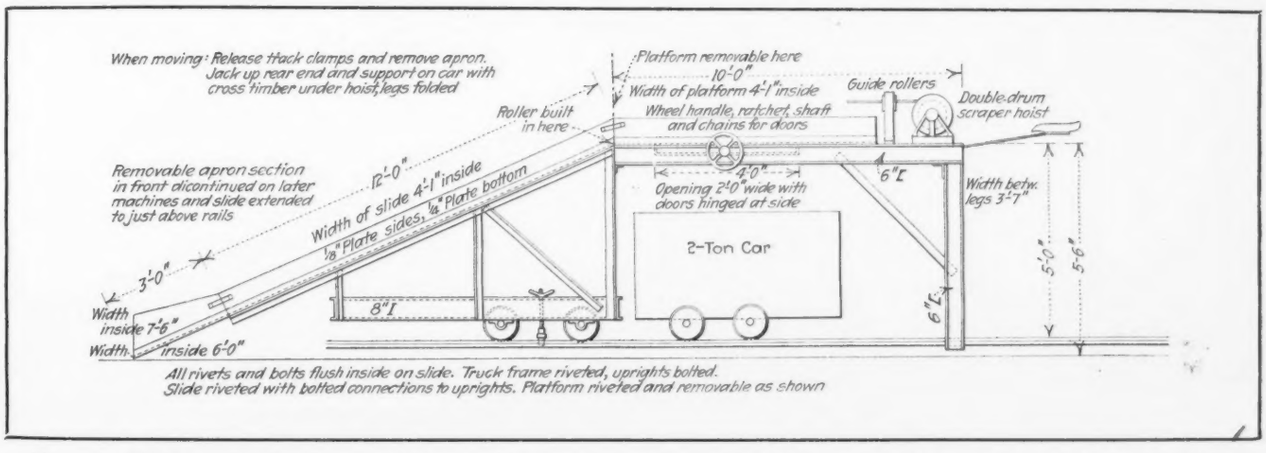
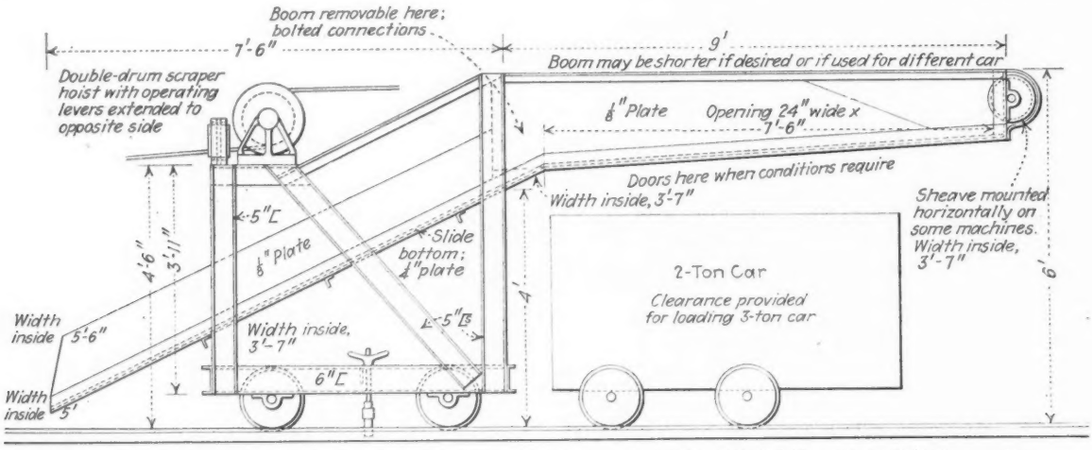

When moving: Release track clamps and remove apron. Jack up rear end and support on car with cross timber under hoist, legs folded
Platform removable here
10'-0"
Width of platform 4'-1" inside
Guide rollers
Double-drum scraper hoist
Roller built in here
Wheel handle, ratchet, shaft and chains for doors
Removable apron section in front discontinued on later machines and slide extended to just above rails
12'-0"
Width of slide 4'-1" inside
1/8" Plate sides, 1/4" Plate bottom
4'-0"
6"I
Opening 2'0" wide with doors hinged at side
Width betw. legs 3'-7"
3'-0"
2-Ton Car
5'-0"
5'-6"
Width inside 7'-6"
8"I
6"I
Width inside 6'-0"
All rivets and bolts flush inside on slide. Truck frame riveted, uprights bolted.
Slide riveted with bolted connections to uprights. Platform riveted and removable as shown

Fig. 1—Platform loader for portable service, as formerly used by Mineral Mining Co., Iron Mountain, Mich.

[1]This would more properly be called a "scraper slide." A "loader" should be a self-contained unit.—EDITOR.

cars. Guide rollers were provided to prevent the rope climbing off the drums. The platform over the car was provided with two swinging doors, chain operated by a shaft, hand wheel, and ratchet. Material could be loaded on the platform while cars were being switched, thus permitting more continuous operation of the scraper. The operator's position gave a clear view of the working face and the scraper at all times.

or vertical column bar near the curve, was used. For widening drifts, for mucking material from raises before chutes were installed, and for other special work, large eyebolts were used to support the block, short holes being drilled at an angle in the side and the eyebolt being wedged into the hole. The loaders are provided with a pair of track clamps mounted between the truck axles. These and the weight of the machine



All rivets and bolts flush inside on slide. Truck frame riveted; channel uprights bolted; Slide riveted with bolt connections to uprights; boom riveted and separable as shown.

Fig. 4—Osana loader, as finally developed

Reversible bottomless scrapers of the Quincy type were used; width 3 ft., length 3 ft. 3 in., and height 15 in. These were provided with a renewable cutting edge on one side and teeth on the other. Their weight was

Fig. 3—Platform loader, scraper end

about 350 lb. A heavy steel rail was riveted across the back of the scraper, to which the pull-back (tail rope) cable was attached. This also gave additional weight, besides strengthening the bucket and giving a foothold for riding the bucket when it was digging in for a load. The only other equipment was the block placed at the face for the tail rope.

For ordinary drift work a heavy column bar was mounted across the drift as close to the face as possible, the block being fastened to the bar by a chain so that it could be shifted sideways. In mucking around a sharp curve an extra snatch block, mounted on an eyebolt hold it in position and take up the pull from the hoist, blocking or sprags being unnecessary.

From the beginning of operations on the fifth level good results were obtained with the scraper equipment described. In mucking a main haulage drift 9x9 ft. in cross-section, 4 to 4.5 ft. per round, the mucking time varied from one and one-half to two hours, fifteen or more two-ton cars being loaded per round. This permitted one complete cycle of mucking, drilling, and blasting per eight-hour shift, with a safe time margin.

As illustration of the range of work possible, the rock from a pump sump and storage drift was loaded directly into cars on the main level. The sump was rectangular, about 10x12 ft. and 12 ft. in depth, with a storage drift extending about 80 ft. on the level of the bottom of the sump. The loader was set in position in front of the sump and an incline of loose rock left on the side toward the loader for the bucket to travel upon. A push button and electric bell system was used to signal the operator from the face, as this was invisible from the machine. Almost as fast time was made in mucking as on the regular drift work. It is doubtful whether any other type of underground loading equipment could have handled work of this nature, delivering the material into cars on the main level.

Experience with the first loader indicated that it could be improved by reducing its length as much as possible and by making it self-contained by eliminating the legs at the rear end, features that interfered with its portability and made it more difficult to load around curves. The Osana loader was thus developed, Fig. 4 and Fig. 5. This machine is self-contained. When moved to a new position, all that it is necessary to do is to set the track clamps and fasten the tail-rope block at the face. The slide extends to a position just clearing the rails; a hinged section is therefore not required in front. The practice is to leave a couple of scraper loads of material at the toe of the slide to carry the scraper onto the slide. The hoist was moved

to the front and supported on a small platform over the slide, sufficient clearance being allowed for the scraper to pass underneath. The incline is shorter and steeper. The loading platform over the car is also shorter and is carried as a cantilever from the slide and trucks.

The change in the position of the hoist necessitates the addition of a rear sheave mounted on the platform boom. The hoist balances the weight of the platform boom. Its position above the slide increases its accessibility and avoids the extra sheaves required on scraper loaders having the hoist mounted under the slide. The operating levers have been extended out to the side of machine, so that the operator stands at the side near the front of the machine, thus giving him a close view of the breast and material being loaded. The levers are conveniently arranged for speed.

The cantilever boom construction at the rear has been found to be amply strong and advantageous. The mine locomotive can spot the cars for loading and pull them out without interference. If conditions require hand tramming, the trammers have clear access to the cars. In changing, the mine locomotive moves in directly under the boom (if dimensions of locomotive do not permit this an intermediate car can be used), couples directly to the slide frame, and moves the loader at a good speed over the mine tracks. When the loading has been completed at a given point, a complete change can be made to a new position several hundred feet away and loading resumed in from ten to fifteen minutes, which time includes the releasing of track clamps, pulling in of tail-rope block, moving, setting up tail-rope block, and attaching track clamps.

The materials handled to date on the Osana fifth level have varied from a hard black cherty iron carbonate to a rather soft, easily broken ore. The sizes ranged from chunky material to finely broken ore. Much black slate rock has been handled. Two-ton cars have been loaded in one and one-half minutes, and a four-minute rate has been maintained for an hour or more, part of the time being due to car delay. Seventy two-ton cars are easily loaded in seven hours, loading in only one place at a time. A higher output could be secured if it were desired to load at more places. The exact type and size of scraper bucket that will handle a given material best must be determined.

The Osana loader weighs 2,000 lb., including the weight of hoist, cable, and trucks. Aside from the hoist, wheels, and sheaves, the other parts can be repaired in the mine shop. By carrying spare parts all necessary repairs can be made. Few parts are subject to wear. As most mines use a number of scraper hoists in their operations, the best plan is to standardize on one make of hoist and then provide a spare unit.

It is interesting to note the points of similarity between the Osana loader and the scraper car loader developed by the Calumet & Hecla Mining Co. (*E. & M. J.-P.*, Vol. 116, p. 502). The position of the hoist over the incline is the same for both loaders, but the C. & H. machine illustrated has no platform over the car and the rear sheave block is supported in the back of the drift. Track clamps are not used, but apparently a column bar is required to hold the machine in place.

Though conditions at certain mines undoubtedly make the use of the underground shoveling type of machine more advantageous than the scraper loaders, such cases would be exceptional, in my opinion. Observation of a number of the shovel types of machines in operation at various iron mines has led me to the conclusion that the objectives could have been obtained just as advantageously with scraper loaders, both with respect to operating costs and speed of loading. This does not take into account the lower first cost (about one-third) of the scraper loader, and its lower maintenance cost, as well as its greater freedom from breakdowns.

At most mines, when drift loading on the main levels is not in progress, the scraper hoists, buckets, and sheaves could be taken onto the subs for sub-level

Photo by U. S. Bureau of Mines.

Fig. 5—Operating the Osana loader

openings and direct mining, thus putting the larger part (about three-quarters) of the total investment for this equipment into almost continuous service. This is in contrast to the limited service obtained at most mines from the shovel type loaders.

A further advantage over the regular shovel type underground machine is the greater operating time per shift if work is available. This is especially the case for the ordinary drift work in mining. The scraper loader, after filling one car and during the interval while another car is being spotted, can continue in operation, hauling material to the slide, thus decreasing the time required to hold the next car. Where there is headroom sufficient to permit of equipping the scraper-loader platform with doors (10 in. being probably the minimum vertical height for this feature), it is generally possible to utilize the full time required for switching cars, thus giving continuous operation.

A daily log of the shovel type of loader working under the same conditions as to track and car supply will show the same time waiting for cars as for loading. Even in especially difficult material, the scraper type machine can average fully as many cars loaded as the other type of loader. This does not take into account the loss of time with the shovel type of machine due to breakdowns, which is almost negligible with the scrapers. A further advantage is the adaptability of the scraper loader for electric power. A compact electric scraper hoist with as simple a control as the air hoist can be obtained at about the same cost. This offers a large saving in the cost of power and relieves the compressor equipment at the mine of this demand.

It is not the intention to patent or attempt to patent any of the features of the scraper loading equipment described. Nor is it believed that this equipment conflicts with any existing patents. Any mine may therefore make use of the information given herein. The loading machines described were designed by Fayette E. Brown, of the Mineral Mining Co., and myself, and were built in the mine shops at Iron River.

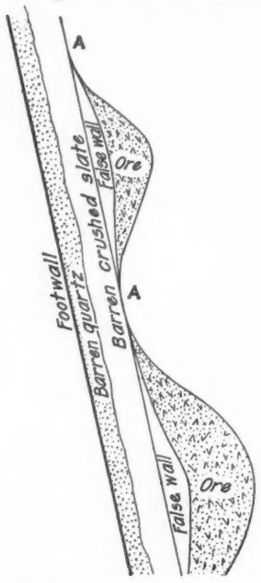
DISCUSSION

"Ore-bearing Parallelisms"

THE EDITOR:

Sir—Mr. MacDonald's letter in your issue of March 15 interests me because of similar experience in the part of Mexico he writes from, and here as well. In Cornwall it is an occurrence well known and recognized since the earliest times of lode mining. In his "observations on the west of England mining region" the late J. H. Collins speaks frequently of it, and quotes many authorities.

I agree heartily with your contributor that a discussion on this and on like matters of mining interest might serve the best of purposes. Administrative and metallurgical practice, engineering in all its branches—the attention given to them—seem almost to have stamped out real interest in actual mining—finding and developing ore. And yet, it must be conceded, all the rest are subordinate to this first essential! Should I succeed in living to a respectable old age the miner, proper, may be "as extinct as the dodo." So it would now seem.



The ore occurs on hanging wall side of fissure, wherever the dip of the rolling wall flattens

For some time I have been developing a property in this district where the lode principally worked exhibits one of the characteristics Mr. MacDonald speaks of, in a marked degree: there is a hanging which might fairly be termed a "rolling" wall, and when the dip is flat it makes ore; when it straightens up the ore vanishes. The ore makes, I should say—invariably—on the hanging-wall side of the lode fissure.

It is an adit-mining proposition in Devonian slate. In a total length of nearly 1,000 ft. of adit on this lode, at a depth varying from 50 to over 300 ft. from surface, about 560 ft. have been in ore; not continuously, but in lens-like occurrences of from less than 50 to, in one case, more than 200 ft. in length, this longest shoot being at the greatest depth yet reached.

The ore itself is quite a typical "breccia"—sharp, angular fragments of barren primary quartz of a chalcedonic character, a deal of chalybite and a gray, secondary and cementing silica which carries all the mineral: iron and copper pyrites; pyrrhotite, galena, and gray copper and silver ore, tennantite and tetrahedrite. The lead and copper values are but 2 to 3 per cent in each case upon an average, and the nickel content is much less. The cash value is in the silver, about 40 oz. per ton: 20 oz., as a rule, per unit of gray copper.

This roughly sketched cross-section of say a 60-ft. raise or winze will serve to illustrate how this ore occurs. As shown, there is a hard, firm footwall, and on this about 2 ft. of barren, iron-stained quartz. To the quartz succeeds about 3 ft. of soft, crushed slate, which does not even need blasting; this also is barren save for a deal of pyrite. To this again follows what is sometimes the true hanging wall as at *A*, and at other times a false wall, behind which is the ore: lens-like bodies of either large or small dimensions.

Simple as it may appear on paper, this false wall is deceptive in the extreme. So far, and after some years, I have had only one man who could follow on from orebody to orebody when I was myself absent. When in the ore all goes well; as the lens "feathers out" the men too get lost. This wall varies from a few inches up to a couple of feet in thickness, and is hard, tough, and smooth, made up apparently of crushed slate, with considerable silica and hydrated iron. To the uninitiated it is "the real thing"—they would never dream there was anything back of it. In it, at times, one finds almost every variety of lead, copper, and nickel ores, but never so far in commercial quantity as in the ore breccia behind it.

The same difficulty which prevails in following these orebodies in raising and sinking obtains also in driving on them. It is, however, a very interesting and instructive type of occurrence, and as the ore is rich it is a lode of much promise if intelligently developed. All the minerals in the breccia itself are in sulphide form, and a high recovery has been shown by flotation tests.

Liskeard, Cornwall, England. A. SPENCER CRAGOE.

Keeley's Prize Nugget

THE EDITOR:

Sir—Your correspondent R. Gentum gives in your issue of April 5 particulars regarding large silver nuggets and masses of silver ore. He correctly discriminates between a nugget and a mass or block of ore, the former being a lump of native metal such as gold or platinum, found not in place but in unconsolidated material, as in alluvial diggings. The word is undoubtedly allied in origin, as it is in meaning, to the word *ingot*. Mr. Gentum, however, is mistaken as to the present location of the block of ore taken from the Keeley silver mine, in South Lorrain. This is not on exhibit in Canada, but has been forwarded for display to the British Empire Exhibition in London, and is believed to be the largest and most valuable single piece of ore ever taken from any mine in the British Empire. It measures 3 ft. long, 3 ft. high, and 2 ft. wide; it weighs 4,402 lb. avoirdupois, and is estimated to contain 24,111 troy ounces of silver.

Mr. Gentum's figures are astray as regards the silver contents of the 3,850-lb. block of ore from the Gibson mine, in Colorado. If entirely of silver, it would contain 56,146 oz., not 36,146 oz. HUGH RONYAN.

Toronto, Ont.

What's Wrong With Mining Engineering?

THE EDITOR:

Sir—In your issue of April 5, Botryoidal Bill's whimsical screed must have touched a vital spot in the armor of many a mining engineer. What is wrong with the profession today? One graduates from a technical school, full of hope, ambition, and enthusiasm. At first every other consideration is submerged to that of experience. Salary, living conditions, and other factors are minor considerations. We are carefully preparing for our life work. In the back of our head we have a vague picture of ourselves, some years hence, serenely settled down to a responsible position, earning enough to lay aside for the kiddies' future; and hoping that when we have reached Osler's limit we can retire to a modest home satisfied that we have been of some use in this old world.

How often our dreams are rudely shattered!

During the World War I was made superintendent of a mine. It had never paid any dividends. By energetic and conscientious work the mine was rejuvenated and made a success. By improving methods of mining the increase in the cost of ore was only 20 per cent, while wages were increased 45 per cent and materials almost as much. I was congratulated by the president.

The war ceased. The demand for ore lessened. At last I looked forward to a breathing spell. Perhaps I might even go on a month's vacation.

Instead, appeared a so-called industrial relations expert, who informed me that he had been engaged under a year's contract to make us into a model mine. When I found that he planned to use a larger proportion of our past earnings for making improvements that were "to enrich the lives of the men," but which the men didn't want, I knew the time had come for me to get out and start over again.

The expert lasted two months, and the mine has not paid another dividend.

I soon landed another job—at a reduced salary—with a large mining company. It meant two years in the woods away from my family, prospecting a large property. At the end of that time I was placed in charge of a group of mines for the same company. Evidently I had made good. Two years passed and a consolidation took place. Absorption would be a better word. The new company decided to dismantle my mines. They asked me to remain with them. The lessors allowed us but a limited time to clean up. That summer we worked at breakneck speed. Shortly before we finished the new company told me that they were pleased with my work and wanted me to take charge of another of their properties about 100 miles away.

The morning after we had finished dismantling, I had bidden goodby to the last of the men and was half planning a week end in the city, when headquarters called me on the telephone and wanted to know why in blazes I wasn't on my new job 100 miles away. I finally agreed to start in two days, utilizing the intervening forty-eight hours to move my family.

At the job I left I was getting bricklayer's wages. At my new job I was to get hod carrier's wages!

The story is about told. The new mine was very much run down. The cream had been skimmed. For four months I was on the job twelve hours a day, seven days a week. The strain began to tell. I resigned.

Mr. Editor, don't you think I have a right to sign myself A. GROUCH.

Stroudsburg, Pa.

P.S.—I dreamt last night that I was offered a job where I would have every Sunday off!

A Prospector's Autobiography

THE EDITOR:

Sir—You ask, What has become of the prospector? The following is practically a true statement that covers thirty-two years mining and prospecting, and I hope this experience soaks into the brains of our new crop of miners; if some parts of my yarn should show signs of a bull ape, don't condemn me. Nobody consulted this miner before his arrival on this earth in the year 1876, whether I wanted to be a crooked lawyer, a statesman, or mucker. Have followed mining since 1892, and I know I am now in the first round in mining and prospecting. About the only point I am sure of is that the mines and rocks rotate in an easterly direction, 19 miles a second, which movement changes the time every second in twenty-four hours.

In past days mining education did not come to the miner, but in 1924 the government sends professors to lecture to prospectors on rockology, and gives us a free talk feast; and every miner not affected with a hookworm attends and takes on a load of valuable information.

As to prospecting, I started in 1892. The first six months I worked on a windlass, with a fake partner, for a half interest in a gold mine; my partner, having taken a contract doing assessment work on company ground, collected the coin, and left me holding the double cross. Then came fifteen years' actual labor in different mines, working for grubstakes. Fourteen months' labor were donated to Uncle Sam in 1898, in Cuba pack-train service. The next item is sixteen months' prospecting on what appeared to be abandoned ground, where I found a cut stone buried in the sand wash, with survey numbers. I could find no record in the County Office: traced the numbers down in the U. S. Mineral Office, where I was told they were floating claims, surveyed in 1860, and not tied on to any point where Government Office could locate them. In the meantime the owner gets wise, pays up back taxes, and I pack the burros and vamoose.

About three years then, during hard times and panics, making twenty-four free speeches every day between the hours of 6 and 8 a.m. on somebody's good mother's back platform, or porch, for a breakfast. Right here the writer will thank these good souls again. About eight years altogether hunting lost pack burros and cussing. Say six months cranking up a second-hand Ford and repairing same, and some expert blaspheming; perhaps thirteen months playing stud-horse poker, trying to win a stake large enough to buy a mine all lit up and paying dividends regularly. My spare time has been spent reading the Bible and the mining journals—"Great Dope" I say. There were four winters in Alaska: five of us were held up in a cabin seven months at a time, each one taking his shift trying to tell the biggest lie, and if old Ananias had heard our noise, we would have been pinched for infringing on his "special privileges."

She is a rough old road, this prospecting, but that's what makes her attractive. E. B. FOSTER.

Kingman, Ariz.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

MINING COMPANIES of Bingham, Utah, and the Utah Copper Co. at its concentrators at Garfield have joined the smelters in Salt Lake Valley in increasing wages 25c. per day. Miners' wages are now $5 per day, which is still 25c. below the scale at Park City and Eureka.

Hamilton, Nev., the old bonanza silver camp of Treasure Hill fame, is being revived by the Tonopah Mining Co. and other operators.

The Hollinger Consolidated Mines Co. must fulfill the contract to purchase power entered into with the Northern Canada Power Co. in 1912, according to a recent court decision.

The Alaska Juneau Mining Co. has adopted a plan for wage-bonus payments based on output in its treatment plant.

By raising and sinking simultaneously, the Verde Copper Co. finished 856 ft. of its three-compartment shaft at Jerome, Ariz., in ninety days.

Financial difficulties have forced the Seneca Copper Corporation to shut down its Seneca and Gratiot mines, in Michigan.

Gold-dredge construction by the Kafue Copper Co. will begin soon in the Cariboo district, in British Columbia.

A shoot of rich silver-lead ore is being developed in the Dominion mine, situated near Colville, Wash.

With the collection of a new assessment of 30c. the Tuolumne Copper Mining Co. proposes to deepen its shaft at Butte to 2,600 ft.

Increased bullion shipments from Tonopah, Nev., indicate a monthly rate of output of about $400,000.

Tuolumne Plans Sinking Main Range Shaft to 2,800 Ft.

New Assessment of 30c. Delinquent May 14—Jahn Thinks Chances Good

The Tuolumne Copper Co. is engaged in unwatering the Main Range mine, at Butte. Preparations are being made for sinking from the present 2,200 level to the 2,800 level. When this lower depth has been attained the management expects to continue development, which it is hoped will disclose important orebodies.

According to a statement of President William P. Jahn, "All of the deep development work in the Butte district has resulted in opening orebodies of exceptionally high grade, and recent explorations and deep development in properties adjoining Tuolumne holdings on the south and west have resulted in opening primary orebodies of higher grade and greater extent than were found to exist on the upper and intermediate levels.

"In the mines of the Anaconda company, immediately on the west of the main Range and Colusa-Leonard extension mines, large bodies of high-grade copper ore have been developed at a horizon which in the Tuolumne properties will be reached at about the 2,600 level. The veins in which these orebodies occur have an east-west strike, of course, and the main ore-bearing fissure traverses both the Colusa-Leonard extension and the Main Range groups. There is every indication that similar orebodies will be developed on the lower levels of the Tuolumne properties."

The company has decided on another assessment of 30c. a share, payable on or before May 14. All stock on which assessment is unpaid on May 15 will be considered delinquent.

Complete 856 Ft. of Shaft in Ninety Days

IT IS believed that a new record has been made by the Verde Central Copper Co. at Jerome, Ariz., in completing 856 ft. of a three-compartment shaft in ninety days. This shaft, which is to be the new main working shaft for the mine, was scheduled to be finished May 1 and it is now estimated that the job will be complete by April 25.

Raises have been put up from the various levels of the mine and the work of constructing the shaft expedited in this way. The foundations for buildings and machinery are ready at the new surface plant, and it is expected that work of erecting the equipment will be rushed and exploration work will soon be started from the new opening.

Teck-Hughes Sells Treasury Shares to Finance New Work

Will Sink New Shaft and Add to Mill—Net Gain of $500,000 in Ore Reserves

To finance the sinking of a new shaft and future mill additions, Teck-Hughes Gold Mines, Ltd., of Kirkland, Ontario, will sell treasury stock, of which there are 500,000 shares. This will bring the date for the initiation of dividends appreciably closer, although as yet no decision has been reached as to when dividends will start.

The new shaft will be equipped for a depth of 2,500 ft. but for the present will be sunk to only 1,500 ft. Work will be carried on simultaneously from the surface and from two levels, so that fast time in completing the task should be made.

The present mill is only equipped to handle about 125 tons of ore per day. Since it was built, the company purchased the adjoining Orr property, in February, 1923. Recent efforts to buy the Kirkland Lake mine and mill, adjoining on the west, seem to have fallen through.

During the last six months the company produced approximately $500,000 and in addition made a net gain of $500,000 to the ore reserves. March production was 3,779 tons of ore averaging $26.45, from which bullion returns totaled $99,949.

Kafue Copper Co. Will Dredge 31c. Gravel in Cariboo

Machinery at Quesnel—Long Overland Haul—6,000,000 cu.yd. of Dredgeing Ground Indicated

The Kafue Copper Development Co., of London, which recently was registered at Victoria, B. C., as an extra-provincial company with an authorized capital of $1,150,000, has let a contract for the construction of a dredge to C. W. Moore. The machinery for the dredge has arrived at Quesnel, the present terminus of the Pacific Great Eastern Railway, and now is being freighted to Antler Creek, where it will be assembled. The distance is 70 miles; for the first ten, wagons are used, and sleds for the remainder. The cost will be 1½c. per pound for the haul from Quesnel to Antler Creek and the weight of the machinery is about 270 tons.

The dredge will be equipped with buckets of 4-cu.ft. capacity and is expected to have a total capacity of 60,000 cu.yd. per month. During last season, W. E. Thorne, engineer for the company, outlined 6,000,000 cu.yd. of ground, averaging 31c., with a Keystone drill on Antler and Cunningham Pass creeks, and it is expected that large additions will be made to this yardage by drilling exploration during the present summer. This will be the first dredge that ever has been operated in the Cariboo district, from which about $50,000,000 in gold has been taken by hydraulicking, drag-scraper, and hand mining.

Mesabi Iron Co. Will Increase Shipments of Sinter

The Mesabi Iron Co. has been shipping its current output of sinter from its plant at Babbitt, Minn., to the ore docks at Two Harbors since April 16. This amounts to 400 tons per day.

Beginning May 1 sinter from the stockpile, which contains 45,000 tons, will begin moving. An additional sintering machine now being installed at Babbitt will be in operation about June 1, increasing the daily capacity of the plant to 800 tons, according to W. G. Swart, general manager.

Arizona Asbestos Company Fills Orders From Holland

A shipment of crude fiber has been shipped by the Riga Asbestos Co., operating the Sierra Anchos property, near Globe, Ariz., to the N. V. Nederlandsche Asbest. Maatschappy, of Rotterdam, Holland. The purchasers made tests of sample lots in comparison with samples from Canada and South Africa before placing the order.

The Arizona asbestos district extends over a wide belt for about 75 miles, and it is believed by engineers who have gone over the country that an output of 100 tons of No. 1 and No. 2 crude could be mined monthly. The maximum output in any one year, according to the records of the Arizona Eastern Railway, was 2,527,000 lb., in 1920.

Where Are All the Good Prospects Hiding?

FINDING a new mine seems impossible for the engineers of the Barnes King Development Co., of Butte, Mont., according to the recent report to the stockholders. It shows that diligent search has been made for additional property that would have a fair chance of being profitable on the investment involved. "To the end of 1923," reads the report, "we had considered 780 outside mining properties, of which we examined 409. These examinations have taken us into nearly all of the western states, and into Alaska and British Columbia. Furthermore, through the kindness of other mining companies we have had access to and carefully considered about 1,000 reports on mining properties made by their scouts, but in these reports there were only three or four properties which we considered worthy of further investigation.

"The result of this scouting to date has been that we have, at various times in the past, taken under option fourteen different properties which to us seemed worthy of further development, but after doing considerable of such development work we were convinced that the showings did not warrant our purchasing the properties, and the options were consequently dropped."

In his report to the officers, George T. Magee, manager, said:

"The year closed with active searching going on for a suitable property to purchase, and with the increasing interest being shown in mining and prospecting it is hoped that a promising venture can soon be undertaken."

North Butte Pushes Work on Superior, Ariz., Prospect

The North Butte Mining Co. is now working three shifts at its leased property near Superior, Ariz., pumping out the shaft and making preparations to start development work. It is expected that the water will be lowered sufficiently within ten days so that the work can be started.

This company recently completed a connection with the transmission line from Roosevelt dam that also supplies Magma Copper Co. with power, and new machinery is being installed that will facilitate the carrying out of exploration work.

Mendha Mill, at Pioche, Running; Bristol Resumes

The Mendha mill, recently completed by the Pioche Union Mines Co., has been running steadily for the last two weeks and turning out a satisfactory grade of concentrates. Trouble from water shortage was encountered during the initial tryout, but ample water is now available.

Shipments will be resumed early in May from the Bristol district. Repairs to the cable tramway are being made, and the lumber for the terminal bins is now on the ground. Work at the Bristol mine was suspended last December, when fire destroyed the bins and the terminal supports of the tramway.

Work Progresses on Tonopah "Ex" Diesel Plant

Excavation for the new power plant of the Tonopah Extension is practically completed, and work on the concrete foundation soon will be started. The building is to be of steel construction, and large enough to accommodate three 2,000-hp. Diesel engines. One unit is to be installed at present and others in the future as needed.

Hamilton, Nevada, Old Bonanza District, Revived

Interest in the Hamilton district, in Nevada, is increasing since the Tonopah Mining Co. started to make preparations for active development of the Treasure Hill mines. The Aladdin Divide Mining Co. has purchased the Virginia group, adjoining the ground acquired by the Tonopah Mining Co., and expects to start development soon.

It is also reported that the W. J. Loring interests have purchased a group of four claims adjoining the Aladdin ground.

The Tonopah Mining Co. is shipping in machinery and supplies and will start work as soon as the necessary dead work can be completed.

The Rocco-Homestake mine, near Hamilton, a lead-silver mine with quite a record for production, has been leased to Ely operators. Present lessees plan to crush the ore coarse, and by the use of jigs concentrate to a 40 per cent lead product. This mine is said to contain some tonnage of carbonate ore which will run 40 per cent lead, and can be shipped at a profit.

Good Ore Shipped by Talapoosa Lessees in Nevada

The discovery reported several weeks ago in the Ferretto lease in the Talapoosa mine, in Lyon County, Nev., continues to show promise of becoming an important orebody. The leasers are putting up a raise to the surface, both for ventilating and development purposes, and do not contemplate doing any stoping until this raise is completed. The raise is up 70 ft. above the tunnel level and has about 180 ft. to go to reach the surface. The material from the raise has been saved for mill ore, and has averaged $11 per ton, mostly in silver. About ten tons of high grade has been saved, and a small shipment indicates this ore to have a value of $246 per ton.

Granby Consolidated Did Well in 1923, Despite Disaster and Low Copper Market

Operating Profit $777,326—Outsider and Copper Mountain Mines Acquired—Falls Creek Dam Completed—Potential Output 5,000,000 Lb. per Month

GRANBY Consolidated Mining, Smelting & Power Co.'s report for the year ended Dec. 31, 1923, shows that, despite a strenuous year, during which the company's plant suffered loss of equipment and operating time from fire and flood, and in the face of a depressed copper market, the company made a net operating profit of $777,326.45 after providing for interest on bonds and bank loans, insurance, taxes, and administrative expenses, but the further provision of $1,494,613.02 for depreciation, depletion, and capital loss caused by forest fires left the company with a deficit of $717,268.57 for the year, which, together with the deficit carried forward from the previous year, gave a total deficit at the end of 1923 of $1,423,366.43.

Diamond drilling and other development during the year added 340,000 tons to the ore reserve at the Hidden Creek mine, and mining operations extracted 695,290 tons from it, leaving a reserve of 8,600,700 tons of 2 per cent ore. To this must be added 1,440,700 tons of second-grade ore, running 1 per cent of copper, which it is thought can be treated profitably by concentration. The company acquired the Outsider mine, at Maple Bay, Portland Canal, where diamond drilling operations and other development indicate an ore reserve of 500,000 tons, running around 2.5 per cent copper, with the probability of this being considerably augmented by further development.

Construction during the year consisted of the completion of the Falls Creek dam—said to be the largest multiple-arch dam in Canada—which gives an additional storage capacity of 28,093 acre-feet, which is sufficient to run the mine, mill, and smelting plants at full capacity for 100 days.

A new 5,000-hp. vertical hydro-turbine generator has been added to No. 1 power plant and a directly driven motor was added to No. 2 power plant, to drive a second-hand 3,500-cu.ft. compressor, which, also, has been added to the equipment.

A new concrete powder magazine was erected, to replace the one blown up during the forest fire, last year. J. T. Crabbs, the president of the company, stated that these additions have appreciably reduced the cost of production for the four months ended March 31, 1924, details of which will be included in next year's report. The new 1,500-ton concentrator was practically completed, but was not put into operation until March of this year.

Through exchange of Granby stock, the company acquired 99.75 per cent of the outstanding stock in the Allenby Copper Corporation, and some diamond drilling was done at Copper Mountain and equipment was added to mine and mill, which now are ready for operation as soon as the copper market warrants an increased production of metal.

During the year the company smelted 863,532 tons of ore and obtained 32,562,459 lb. of copper, 442,604 oz. of silver, and 8,193 oz. of gold.

The mines and equipment at Anyox, Copper Mountain, Allenby and Maple Bay would enable the company to produce 60,000,000 lb. of copper per year, should the demand for as much metal arise. This, Mr. Crabbs pointed out, is equivalent to 174 lb. per share of issued stock.

Tonopah Bullion Shipments Increase

BULLION shipments from the Tonopah district, in Nevada, covering operations for the first fifteen days of April, indicate an increased rate of production. The Tonopah Extension shipped bullion valued at $110,000, the West End $35,200, and the Tonopah Mining Co. bullion is estimated as valued at $55,000. At this rate April production will exceed $400,000 in value.

Optimist Mining Co. Finds Ore Near Diamond, Mo.

The Optimist Mining Co., in which George W. Moore, of Joplin, represents the leading interest, is successfully blocking out a shallow lead run on the Byrd land, located about halfway between Diamond and Duenweg, Mo.

The company recently secured approximately 1,400 acres of leases along the county line road, southeast of Joplin, and almost all of it is land upon which no mining operations have ever been carried on. For the present the company is contenting itself with searching for shallow lead deposits, and no ore has been found below 150 ft., but later on deeper drilling will be done. A number of smaller companies have taken subleases on the Optimist tracts and will seek to develop shallow lead deposits.

Develop Warren Manganese, Property Near Deming, N. M.

For six months development work has been going forward steadily on the Warren manganese property, about 12 miles southeast of Deming, N. M. The mine is being worked under lease by West & Murray, who are erecting a 100-ton concentrating mill and have built a number of other necessary buildings.

Two tunnels have been run, about 250 ft. in length, showing an orebody about 100 ft. in width. This consists of a vein filling of conglomerate, cemented with pyrolusite, and runs about one part of ore to three of waste. A new tunnel will be started at once that will give about 200 ft. of backs in about that distance from the portal. What is known as the Parkhill dike, which is here heavily mineralized, has been crosscut, showing the ore to be about 30 ft. wide. Prospect holes have been sunk at intervals along this for 3,000 ft., showing a good grade of ore. A forty-acre tract of land has been purchased on the flat east of the mine, where two water wells will be sunk and a pipe line run to supply the mill with water.

A trial run of the ore was made in El Paso before the mill was shipped and gave good results. Fifteen miners are carrying on development work and as many men are working on the mill under the direction of Jim Hoagland. It is expected to have the mill completed by Sept. 1, when regular production should start.

Pioneer Gold Dredging Co. Will Equip Alaskan Properties

The Pioneer Gold Dredging Co., which conducted extensive drilling operations, according to reports, on Cleary and Goldstream creeks, in the Fairbanks, Alaska, district, is expected to install two or more gold dredges during the ensuing year.

Options have been secured on ground of probable dredging value. In 1923, further prospecting was done and additional options were secured.

Tamarack Reclamation Plant Ready by Summer—If Needed

Work is proceeding on final stages of construction at the Tamarack reclamation plant of Calumet & Hecla Consolidated, in the Michigan copper district, and it will be ready for use this summer if needed. Ten pounds or better of refined copper per ton should be reclaimed from the waste sands or tailings of the old Tamarack conglomerate mill.

It is estimated the deposit contains 12,000,000 tons of sand, and operating at capacity it will take about fifteen years to exhaust the supply. The capacity of the plant will be approximately 850,000 lb. of refined copper per month.

Hematite Paint Mine May Be Opened on Nevada Desert

The Red Indian Products Co. is preparing to ship 2,000 sacks of 150 lb. each of high-grade hematite from a deposit that it hopes to exploit. It is situated about 30 miles north of Death Valley in the Nevada desert, and is only 6 miles from the Tonopah and Tidewater R. R.

Samples of the oxide contain virtually no grit, and when ground to 200 mesh or finer make what is said to be an excellent paint for outdoor work. The company hopes to develop a business among farmers, railroads, and ship owners. The paint seems specially suitable for painting box cars.

The present shipment of ore will go to Los Angeles, where it will be ground in a customs grinding plant preliminary to starting a selling campaign.

Labor Union Gains Ground in Joplin-Miami District

WHAT promises to be a successful effort to unionize the Joplin-Miami zinc-lead district is now under way. At this time it is reported that five local chapters have been organized and are meeting regularly, and the membership is steadily increasing. Operators and mine owners heretofore always have successfully resisted efforts at labor organization. The belief has been that this has been largely due to the fact that in many instances the mine superintendents have been shovelers or drill runners before becoming superintendents and managers, and so have been able to exert an unusual influence over their employees.

Hollinger Loses Suit; Must Execute Contract for Power

An action brought by the Northern Canada Power Co. against the Hollinger Consolidated Mines, Ltd., and the Canadian Mining & Finance Co., Ltd., was tried before Judge Lennox at Toronto and judgment was rendered on April 24 in favor of the plaintiffs. It was shown that in 1912 an agreement was entered into by the power company to develop power at Sandy Falls and Wawatin Falls to supply the requirements of the mining companies for the life of their mines in Tisdale Township, Ontario, and that large expenditures were made in the construction of the hydro-electric plant.

In 1922 the power company asked the two mining companies to execute a contract according to the terms of their agreement. They refused to do so, and an action was consequently brought, the power company contending that unless the contract was executed it would find itself with a large power development and no market. The court upheld this view and ordered the mining companies to execute the contract according to the agreement of 1912.

Comstock Buckeye Resumes; Expects Ore in Lower Levels

The Comstock Buckeye company, which owns the Buckeye mine, in the Comstock district, in Nevada, has begun work below the 400 level. It is necessary to pump water out of the old workings and to repair the shaft. The pumping plant is handling the water without trouble, and the shaft is in better condition than anticipated.

The ore mined during the last two years, amounting to 1,000 tons, came from above the 400 level, and was low grade, averaging $12.25 per ton. This area had been pretty well combed by leasers before the company started operations, but the area below the 400 level has never been leased, and there may be a large tonnage of ore of much better grade available between the 650 and the 400 levels. Reports indicate that the vein is wider, up to 30 ft., and contains milling ore, with possibilities for high grade.

Frame Shacks at Bingham, Utah, Give Way to Brick and Steel Buildings

Utah Copper and United States Companies Gradually Change Disreputable Appearance of Canyon Town—New Hotel Accommodates 100 Men

IMPROVEMENTS which will greatly add to the good appearance of the camp of Bingham, Utah, and to the well-being of miners are being made by the U. S. S. R. & M. Co. and the Utah Copper Co. The United States company has completed a new change room and a hotel for unmarried employees, and is planning next summer to build modern cottages for the accommodation of the married men.

The Utah Copper Co. is bringing rapidly to completion a recreation hall, which is to be a memorial to R. C. Gemmell. The company has just completed fourteen brick cottages for its employees, of a type similar to those which it has built at its Arthur and Magna plants, at Garfield. In this way the camp of Bingham is beginning to take on a better appearance, as the haphazard frame dwellings will be gradually superseded, and the larger buildings constructed and in process of construction will give an air of permanence to the camp, which has a long future ahead of it.

The new change house of the United States company, now ready for use, is situated at the mouth of the Niagara tunnel, and is directly connected with it, so that the men have direct access to it from the mine without the necessity of passing first into the outside air in wet clothing. The building—107 by 48 ft.—is constructed of brick, steel, and concrete throughout, and has large areas of glass windows, which give it a particularly pleasing appearance. There are 316 individual lockers. The large shower room, with 32 shower bath compartments, is placed between the two large dressing rooms and the locker room. The building is heated by steam heat. Chains are provided, so that the wet clothing of the men may be hoisted to the roof to dry. There are private rooms and baths for the shift bosses.

The new hotel—169 by 37 ft.—like the change house, is built of brick, concrete, and steel. It offers sleeping accommodation for 100 men in its two upper stories, where the bedrooms and bath rooms are placed.

The kitchen, dining room (capable of seating 200), and lounge room are on the first floor, and in the basement are the heating and refrigerating plants. The hotel offers all modern conveniences, and reading matter is also to be found in the lobby.

The camp of Bingham, situated in a very narrow canyon, with steep mountains rising from it, has presented particular difficulties in the way of the arrangement and building of a town. However, these new constructions will go a long way to giving a more pleasing appearance to the town, which in the past has been something of an eyesore to visitors.

Loon Lake Concentrator Bought by Hewer Company

The Hewer Mining Co. has purchased the concentrator of the Loon Lake Copper Co. near Loon Lake, Wash., and started to take it down and remove it to the Hewer mine, on Lake Pend Oreille. The mill was used only a few months at the Loon Lake copper mine and is equipped with modern machinery, including a flotation plant.

The Hewer mine has been rapidly developed in the last few months, and, according to engineer estimates, more than 60,000 tons of ore is available for the mill, which will be installed and ready to begin operation about June 1 of this year.

F. W. Bradley Options Gold Property in Central Idaho

Fred W. Bradley, of San Francisco, has taken an option on a group of six quartz claims in the Dixie Mining district in Idaho County, Idaho, for the sum of $200,000. J. A. White, mining engineer, acting for Mr. Bradley, is preparing to begin exploration immediately. The property has a good showing, gold being the principal metal. The ore can be treated by the cyanide process.

The government is now engaged in the construction of a truck road directly into this country, popularly known as Central Idaho. It is a very large mineral region covering an area about 40 miles square. There are five separately organized and recorded mining districts within this territory, and according to Stewart Campbell, Idaho Mine Inspector, "within its borders lie the greatest undeveloped gold-mining section of any equal area in the United States."

"Camp Where You Can Only Work and Sleep" Is Cripple Creek

M. J. McCarthy, Colorado State Mine Inspector for the Cripple Creek district, takes exception to the recent action of the District Attorney in closing up all card games of the "trade check" variety, which results, he claims, in a turn to "sure-thing poker" games in back rooms and private places, and works greater harm to the men than when they are permitted to play social games in public places.

Mr. McCarthy claims that there is not only dissatisfaction among men now working in Cripple Creek, but the district is getting the reputation of being a camp "where you can only work and sleep." He urges the operators to arrange for a ball team, and tells them that "any man with ambition deserves recreation and amusement during idle hours, and if not provided in Cripple Creek, many of the miners will leave the camp."

Four Dividend Payers Among British Columbia Mines

DIVIDENDS paid by metal mining companies in British Columbia covering operations for the first three months of this year are Premier Gold, $400,000; Howe Sound, $199,208; Belmont-Surf Inlet, $62,500; and Silversmith, $25,000.

The Consolidated Mining & Smelting Co. certainly has earned more than enough to pay a dividend, but seemingly purposes to continue the system, adopted for the first time last year, of declaring one for the whole year, instead of quarterly dividends. Silversmith, on the other hand, has under consideration the disbursement of monthly dividends, and it is likely that system will be adopted at the beginning of the fiscal year, on June 1. The Silversmith mine and mill are in excellent condition, and if the company is able to steer clear of the threatened labor trouble with its employees it will continue on the dividend-paying list for some years.

Sapphire Pool in Queensland Productive

Under a system of pooling sapphires obtained in Queensland, it is estimated that £50,000 will be received annually in that state. This information was given by the Queensland Minister for Mines (A. Jones), who passed through Melbourne on the steamer "Osterley" on his way to Great Britain. Mr. Jones is chairman of the Queensland committee of the British Empire Exhibition. Explaining the pool of sapphires, which was established about a year ago, Mr. Jones said that about £30,000 had already been received from sales in Great Britain and Europe, and it was estimated that an additional £20,000 would soon be received, as marketing has been reasonably brisk.

Washington News

By Paul Wooton

Special Correspondent

Chilean Nitrate Producers' Association Extended Six Years

Americans Stay Out; Point to U. S. Anti-Trust Laws—No Worry Over Synthetic Competition

The Nitrate Producers' Association of Chile has voted to continue its activities for a period of six years, according to cable advices received in Washington from Chile. With this action has come renewed pressure on the du Pont Nitrate Co. and W. R. Grace & Co., the two American producers, looking to their taking out membership in the association.

It is assumed that there will be no change in the policy of the American producers. Their position in the past has been that since the association is a monopoly engaged in the control of prices, their participation in such an activity would be contrary to the anti-trust statutes of the United States.

When the German producers proposed to stay out of the producers' association, the Chilean government immediately exerted the pressure necessary to thwart such action. It is not regarded as probable, however, that any effort will be made to coerce the American producers into joining.

Apparently, the producers of Chilean nitrate no longer are apprehensive of serious encroachment on their market by synthetic nitrogen. The loss of German business has been more than compensated by the increase in demand for Chilean nitrate in the United States. In Chile, it is believed that Germany would be a large purchaser of nitrate at this time if funds were available for that purpose. It is believed that nitrate purchases by Germany will be resumed immediately on the rehabilitation of Germany's financial structure.

The general belief among producers in Chile continues to be that their product can be laid down at practically any consuming point at a lower price than can synthetic nitrogen, without lowering the rate of export duty now being paid. They are given additional confidence by the knowledge that this duty can be reduced or even removed.

Utah Mining & Smelting Companies Increase Wages 25c.

THE mining companies operating at Bingham, Utah, are making a 25c. increase in wages, effective April 16. The Utah Copper Co. makes the increase at its Arthur and Magna mills at Garfield also. The slightly better price of copper over last fall, when wages were reduced 50c. a day on account of market conditions, is believed to be the reason for the advance. The International smelter at Tooele follows with a similar increase. The American Smelting & Refining Co. and the United States Smelting & Refining Co. have also made increases at the same rate. With the new scale in force machine men at Bingham receive $5, compared with $4.75 a day, and all other classes of labor are paid proportionally. The mines of Tintic and Park City announce no change. The wages at these camps are still 25c. a day in advance of those at the above-mentioned properties.

Concentrates Are "Ores" for Freight Rate Making Purposes

"Ore" rates should have been applied on shipments of zinc concentrates from New Mexico points to Palmerton, Pa., in the opinion of Examiner Mackley, of the Interstate Commerce Commission, in a report to the commission on a complaint brought by the New Jersey Zinc Co. The carriers contended that the commodity description "ores" does not apply to concentrates.

Steel headframe and part of the mill at the Angelo mine of the East Rand Proprietary Gold Mines Co., on the Rand

Alaska Juneau Plans Bonus for Treatment-Plant Employees

Based on Improvement Over Standard of Thirty Tons per Man per Day —Regular Work Necessary

Beginning in March, 1924, the Alaska Juneau Gold Mining Co., operating in Alaska, introduced a bonus system in its ore treatment plant. The company states that the plan is an experiment and that future readjustment or change may become necessary. The immediate plan provides that the bonus will be computed on the shifts worked based upon tons per man per day and will consist of an amount equal to one-half of the labor cost on all tons over thirty tons per man per day.

The statement of the company explaining the scheme says: "For the year 1923 the tons per man per day for this division was thirty. The labor cost per ton for this division for the same year was 12c. per ton. For a starter the tons per man per day and the labor cost per ton for this division for the year 1923 will be used. For the month of March, the tons per man per day for this division was thirty-four, giving an excess of four tons per man per day, which multiplied by one-half of the labor cost, or 6c. per ton, gives a bonus of 24c. per man per day. This amount will be distributed on April 20 to all employees who have complied with the provision under which such distribution is to be made and which are hereafter stated.

"The provisions of this distribution are that a man to participate in the bonus must have worked twenty-six shifts and be working at the time the distribution is made. The bonus distribution will be made on the twentieth of each month.

"No bonus will be paid on overtime. In the event a man is incapacitated by accident he will be paid bonus on such shifts as he may have worked during the month in which he was incapacitated by accident.

Hope for Increased Efficiency

"The company has spent and is spending large sums of money to improve operating conditions, increase output and reduce operating costs. In introducing this bonus the company is sharing with the employees the advantage gained by such expenditures in order to increase the interest of the employees in their work and share with them any saving in cost that can be effected by improved working conditions and a further increased efficiency of labor.

"To further illustrate the possibilities of this arrangement: If 9,000 tons per day tonnage is attained with the same number of men as in March in this division (which is a quite reasonable assumption) a bonus of about 38c. per day would be earned. Assuming a tonnage of 10,000 tons per day with a few additional men (which is still quite within the possibilities) a bonus of between 50 and 60c. per day would be earned."

The remarkable record in so organizing work as to make an operating profit on 80c. ore is a credit to F. W. Bradley, who has been chiefly responsible for the achievement.

The water front at Juneau, Alaska. Part of the Alaska Juneau mill, where a bonus system of payment has been introduced, is seen at the extreme right

London Letter

By W. A. Doman

Special Correspondent

Mongu Tin Effects Economy With Hydraulic Stripping

Saving Should Show in 1924—Output and Selling Price Both Higher in 1923

London, April 15 — Although the Mongu (Nigeria) Tin Mines has passed through a lean time, owing to the low price at which the metal ruled for so many months, the directors have not neglected the question of economy. The company produces tin concentrates by sluicing and calabashing and by dredging, and to reduce the cost of operating the dredge, a scheme for the hydraulic stripping of overburden in advance was initiated some time ago and is now being worked. The cost is certainly very reasonable, as 55,000 cu.yd. was stripped within four and a half months at a running cost of less than ½d. per cubic yard for native labor and miscellaneous stores.

No direct benefit, however, had been felt, as the ground so stripped had not been reached with the dredge, and the reduction in working costs will only be experienced during the current year. This hydraulic scheme is a relatively small affair, but its success has led to the suggestion of a further plan for working certain flats on the Mongu River by means of hydraulic elevators instead of by hand labor. As during the rainy season the labor force is depleted, this also should prove a great benefit to the company. During the twelve months ended Dec. 31 last the company won 472 tons of concentrate, against 427 tons during 1922. The price received was about £35 higher at £147, and expenditures rose from £75 13s. 7d. to £82 9s. The advance consisted chiefly of native wages, royalties, rents, and miscellaneous charges for various small items.

Tin companies have had rather a dull time during the last week, as the price has been down to approximately £254 per ton, and at the moment does not seem like crossing the £300 mark, as predicted by various experts. On the other hand, it is said that the stocks of the metal in this country are very low. The whole position is mainly the result of speculation, to one instance of which I referred in a recent letter. The prevailing feeling is one of optimism in the market.

Since the alteration of the marketing arrangements, the Indian gold-mining companies find it beneficial to dispose of the whole of their production in India, where, owing to the demand for the metal for hoarding, the premium payable is more favorable than in the United States or elsewhere.

Richer Ore From Mysore Mines

During 1923 the Mysore Gold Mining Co. produced 125,045 oz. of fine gold, for which it obtained £493,978, though from this had to be deducted royalty and refining charges, which reduced the amount by £31,576. In addition to the gold produced during the twelve months, stock valued at £81,036 was also disposed of. The cost of winning the gold was £2 18s. per fine ounce. A small quantity of ore was crushed—197,136 tons—compared with 218,079 tons, but the gold content was nearly 1 dwt. higher at just over 11 dwt. The extraction, however, was slightly lower at 98.05 per cent as against 98.15 per cent in 1922. The profit for the year was £197,896, and shareholders receive 2½ per cent more at 22½ per cent.

Gold Standard Requires Little or No Actual Metal, Thinks Keynes

At a debate on monetary policy on Monday evening at the London School of Economics, Professor Keynes said the actual use of gold tended to become reduced even before the war, and in his view a perfect gold standard does not require any gold at all or, at least, only a very small quantity. Apparently he would cease all gold mining, for he remarked that it is absurd to spend a number of millions every year on the mining of gold, only to bury the output into the vaults of the central banks which are prepared to pay its cost of production. According to Mr. Keynes the policy of the Federal Reserve Board is particularly subject to criticism, and it is to the interest of America to close down her mint and to prevent a further huge influx of gold from abroad.

To Get Closest to Earth's Center Go to the Calumet & Hecla Mine, in Michigan

THE DEEPEST MINE WORKINGS in the United States are those of the Calumet & Hecla Consolidated, on the Keweenaw Peninsula, in Michigan. The copper deposits are inclined and the deepest workings are 5,990 ft. vertically below the surface. The deepest vertical shaft is the Tamarack No. 5, which is 5,309 ft. deep; the Red Jacket shaft is 4,900 ft. deep. There are several inclined shafts in the district which are over 8,000 ft. long, but vertically they are not so deep as those mentioned.

The deepest workings of the Calumet & Hecla represent the nearest approach man has made to the center of the earth, as they are about 4,600 ft. below sea level. The other deep mines of the world are at higher elevations and consequently do not go so far below sea level. The deepest gold mine in the United States is in California, where the Kennedy Mining & Milling Co. has a vertical shaft 4,200 ft. deep. Crosscuts connect with the steeply pitching vein.

According to the Federal Bureau of Mines holes have been bored much deeper into the earth than mine workings have penetrated, but no one has, of course, ever been to the bottom of such holes. The deepest hole in the earth is in West Virginia; it was bored to a depth of 7,579 ft. in search of natural gas.

Schreiber Gold Mines Co. Opens Rich 10-in. Vein

Twenty tons of ore shipped by the Schreiber Gold Mines Co. to the Temiskaming Laboratories at Cobalt, Ont., averaged $82.50 per ton in gold. The company has followed a 10-in. vein for 150 ft. The shipment already made is sorted ore.

According to Charles A. Randall, engineer for the company, 65 per cent of the gold is in combination with bismuth telluride, but an excellent extraction by straight cyanidation is possible if the ore is crushed to 250 mesh.

Dominion Silver-Lead Develops Rich Oreshoot

The Dominion Silver-Lead Mining Co., operating near Colville, Wash., has completed a winze from the 500 level to a depth of 150 ft. and is crosscutting to catch the rich oreshoot developed at a depth of 50 ft. in the winze.

A car of ore has been shipped this week to the Bunker Hill smelter which was taken out during the development. The ore developed on the 550 level has been drifted and drilled for over 30 ft. in length with the ore continuing and for over 20 ft. in width. The body carries high lead and zinc values with wire silver woven through the ore in beautiful specimens of picture rock. Channel-cut assays of 1,000 or more oz. to the ton are easily procured.

"Examine" Copper Property with Aid of Electrical Apparatus

Enid P. Yergerg, Edward Hansberg, Hans Dundberg, and Eigne Dundberg, mining engineers of Sweden, have just completed an examination of the Queen Creek Copper Co.'s property near Superior, Ariz. These men used an electrical apparatus in making a survey of the property which aroused much interest among local prospectors. The secrets of the methods used were carefully guarded and no questions regarding the apparatus were answered.

Seneca Copper Corporation Shuts Down Its Michigan Mines

More than 300 men were thrown out of work when the Seneca Copper Corporation's Seneca and Gratiot mines, in the Michigan copper district, suspended operations on April 26, owing to financial difficulties. Some of these men no doubt will find employment at neighboring properties, a number of which are in need of miners and trammers, and others may find it necessary to leave the district temporarily.

It was announced at the Seneca mine offices on April 25 that funds for the March payroll were on the way and it was expected checks would be issued the day of suspension. It is said that efforts toward refinancing will be made, so that the property may be reopened. Lake shareholders expect some new financing plan will be submitted.

Production was averaging about 1,100 tons a day at the time of suspension, and development had reached a point where output could be increased.

Good Profits and New Construction Feature Porcupine District

Dome Earns $505,472 for Quarter; MacIntyre $1,322,266 for Nine Months—West Dome Mill Rebuilt

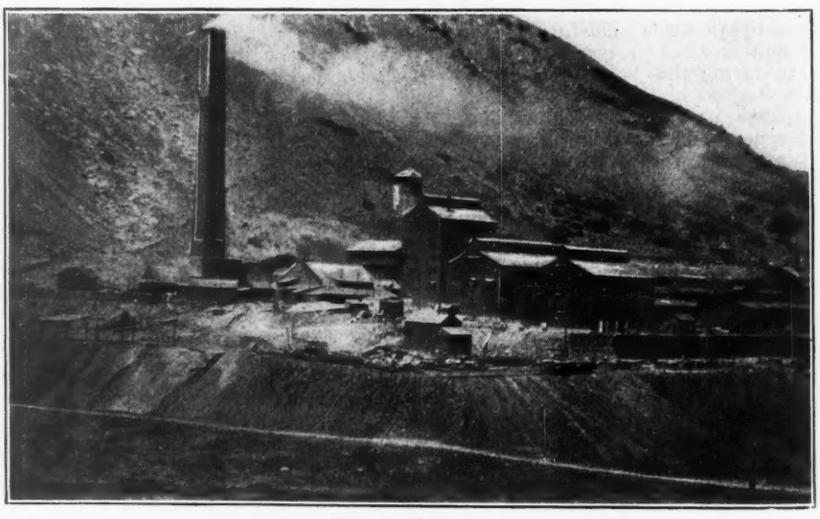
The report of the Dome Mines Co., operating in the Porcupine district in Ontario, for the quarter ended March 31 last, shows that during the period there was milled 116,700 tons, averaging $8.84, giving a total recovery of $1,031,933. Operating costs totaled $565,009, an average of $4.84 per ton, and estimated taxes were $26,635, leaving an operating profit of $440,289. To this is added miscellaneous earnings of $65,183, giving profits for the period of $505,472 before making allowance for depreciation and depletion.

It is understood that as an outcome of the discord that characterized the annual meeting, the class of securities in which the company's funds are invested will be changed to trustee securities and that in the near future one or more Canadians will be added to the board.

The Hollinger is now treating about 4,800 tons a day; it is not expected that the tonnage will be greatly increased above this figure until the company has its own reliable source of hydro-electric power.

The expansion program of the MacIntyre is proceeding and a new 35-drill compressor is being installed. The site for the new deep shaft has been chosen, and it is expected that equipment will soon be ordered. During the nine months ending March 31 total recovery was $2,397,075 and costs, including development, were $1,322,266. Net earnings before plant depreciation were $1,078,656 compared with $971,843 realized during the whole of the preceding year.

The West Dome Lake has started reconstruction of its mill, and it is expected to be ready for operation in about three months. Underground development has been favorable and there is a considerable tonnage of ore ready for the mill.



Skinner furnace
Leaching plant
Crystallizing plant

The Sulphate (Coolbaugh) process plant at the A. S. & R. smelter at Durango, Colo.

Men You Should Know About

H. S. Denny has returned to England from Canada.

E. J. Membrey has left England and is now in Bolivia.

E. Russell Lloyd has opened offices as a consulting geologist in Denver, Colo.

E. P. Crawford has left Guanajuato, Mexico, and gone to Elk Lake, Ontario, to take charge of development work.

C. T. Van Winkle has been in Pioche, Nev., recently, examining mining properties with a view to development.

J. Parke Channing has completed his work in the Tres Hermanas district south of Deming, N. M., and returned to New York.

Frank Reeves, of the U. S. Geological Survey, is continuing his study of the structure in and around the Bearpaw Mountains of Montana.

Ira B. Joralemon, geologist, accompanied by **C. A. d'Autremont** and **H. H. d'Autremont,** is visiting properties in Texas and Arizona.

Walter C. Teagle, president of the Standard Oil Company of New Jersey, has left New York for his annual oil fields inspection trip.

Balmer Neilly, of Toronto, has resigned the secretaryship of the Ontario Mining Association to take a position in connection with the McIntyre-Porcupine.

L. F. Bullard, of the Treadwell Yukon Gold Co., Ltd., is on his way to the Kuskokwim district, Alaska, where his company has interests in mining properties.

D. C. Jackling, president of the Mesabi Iron Co., is expected in Babbitt, Minn., to inspect the company's plant for the production of sinter, accompanied by **Charles Hayden.**

Frank A. Delano, of Washington, D. C., federal receiver for the Red River area between Oklahoma and Texas, recently made a trip of inspection through the disputed oil fields.

John P. Gray, of Coeur d'Alene, Idaho, gave a series of lectures to students in geology, mining, and law at the University of Wisconsin April 17 to 19 on the subject of the "Law of the Apex."

Dr. George Otis Smith, and the President's Commission on Oil Reserves, of which Dr. Smith is chairman, are en route to the West, where visits will be made to the naval oil reserves. The California reserves will be visited first.

A. R. Globe has resigned his position as manager of the Night Hawk Peninsular, of Porcupine, and is succeeded by **Douglas Mutch,** formerly manager of the Anchorite mine and for five years superintendent of the Coniagas reduction plant at Thorold, Ont.

B. S. Sorelle, of Shreveport, La., has resigned his position as operating manager of the Simms Oil Co. in Louisiana and Arkansas and will be production manager for the Pure Oil Co. in Arkansas, Louisiana, Oklahoma, and Texas, with headquarters in Mexia, Tex.

Morton Webber, consulting engineer for the Minas Pedrazzini Gold-Silver Co., was recently at Nacozari, Sonora, on an inspection of the company's Diesel electric power plant, recently completed for the purpose of supplying power to its Las Chispas mine.

F. C. Blickensderfer, metallurgical engineer, is at Globe, Ariz., carrying forth some flotation experimental work. Mr. Blickensderfer is specializing in ore treatment problems and representing the Southwestern Engineering Corporation in the field.

Dr. Heinrich Oscar Hofman

T. A. Rickard has just returned from a trip to Mexico, where he went to look over the Ahumada Erupcion mine, in Chihuahua, where important recent lead-silver discoveries have been made. An article on this mine will appear in a future issue.

Herbert Hoover, who among his other honors is president of the American Child Health Association, was in New York last week to attend the executive meeting of the organization and to confer with local officials in their endeavor to make special arrangements for the exercises held on May Day to direct attention of the importance of the child-welfare campaign.

Charles Butters is in New York, having just returned from his properties in Salvador and a horseback trip through Honduras. During the latter he traversed a revolution, the existence of which he learned from American papers after arriving in the United States. Mr. Butters is firm in the belief that exceptional opportunities for mining enterprise exist in Central America.

Dr. Ambrose Swasey has been presented with the John Fritz gold medal. The medal is among the highest honors in the engineering profession. It was awarded to Dr. Swasey as "a designer and manufacturer of instruments and machines of precision, a builder of great telescopes, and a benefactor of education, and the founder of Engineering Foundation," to the work of which organization he has contributed $500,000.

D. W. Brunton and **W. L. Saunders,** past presidents of the American Institute of Mining and Metallurgical Engineers, have returned from an extended trip in South America. They were particularly impressed with the iron-ore deposits on the properties of the Bethlehem Steel Co. and with the methods being employed in mining and transporting the product to the United States. The former practice of carrying coal down and iron ore back is about to give way entirely to the employment of special boats which are combined tankers and iron-ore carriers. The American engineers were impressed with the fact that the Bethlehem company, which has shipyards of its own, has vessels now under construction in German yards.

Obituary

Dr. Heinrich Oscar Hofman, professor of metallurgy at the Massachusetts Institute of Technology, died at Cambridge, Mass., on April 28. Dr. Hofman had a paralytic stroke in the spring of 1920, but had been able to get about until last winter, though with increasing difficulty. For three weeks before his death he had been confined to his bed. One of the earliest books published by the *Engineering and Mining Journal,* under the guidance of Richard B. Rothwell, was Dr. Hofman's "Metallurgy of Lead and the Desilverization of Base Bullion." This was originally issued in 1892. It ran through numerous editions with minor revisions until Dr. Hofman revised it fully for inclusion in his Metallurgical Series in 1918. This Metallurgical Series consisted of three exhaustive works, "General Metallurgy," the "Metallurgy of Copper," and the "Metallurgy of Lead." Ill health prevented Dr. Hofman from completing his volumes on the "Metallurgy of Gold and Silver" and the "Metallurgy of Minor Metals." Arrangements, however, have been made for the completion of his "Metallurgy of Iron and Steel." Of the above series volumes have been translated into German, French, and Spanish. For nearly thirty years Dr. Hofman contributed annually a review of technical progress in lead smelting to *Mineral Industry.* Dr. Hofman was made honorary member of the A.I.M.E. in 1921, and professor emeritus, M.I.T., in 1922. He had not been able to do any professional work since his retirement.

Henry Lesinsky, who, working as a prospector, discovered the so-called "Longfellow" mine at Clifton, Ariz., fifty years ago, died in New York on April 24. He had long retired from the mining business, making his home in the metropolis. He was eighty-nine years old.

G. A. Eaton, who, with A. B. Coates and Morton Miller, was responsible for the discovery and development of the Miller mine, on the Mesabi range, died recently in Duluth, at the age of fifty-two.

W. H. Whiteside, who had long been a mine captain with the Oliver Iron Mining Co., died recently at Hurley, Wis., after a long illness. Mr. Whiteside was eighty-three years old.

Recent Technical Publications

Reviews, Abstracts, and References

"Away With the Gold Standard?"

The Economics of Freedom. By David Atkins. Published by Duffield & Co., New York. Price $4.

A large part of this book is devoted to a sharp criticism of the gold standard and the shortcomings of our present economic system. The author seems to take a keen delight in showing its defects, the harmful operation of business cycles and inflation or deflation of the currency. Those many other economists, who also realize these deficiencies and have expounded them, will sympathize with his exposé.

Mr. Atkins is on much firmer ground in handling that phase of his subject than when proposing a solution. Having an engineer's viewpoint he chafes at the lack of precision in the measurement of economic values. He would like to have the accuracy of the laboratory duplicated in defining and using economic units, so that the evils of fluctuating currency values in terms of commodities will disappear. He would dispense with the gold standard entirely and substitute money based upon three factors—land, population, and time,—a proposal first made by him in the *Engineering and Mining Journal* in 1920. It is difficult to see just how money of such a character, provided it can be expressed upon paper properly, can prevent the very fluctuations in price levels of which the author complains. To this reviewer it looks as if the cure were worse than the disease.

Land has often been advocated by economists as a currency base. As a matter of fact, the French *assignats* were based upon lands, but nevertheless they dwindled in value quickly. Mr. Atkins' twist to this scheme lies in his inclusion of population and time as additional bases, making the subject much more complex—so much so in fact that one fails to grasp how the author has simplified the situation at all. How will this currency, for one thing, be used in the settlement of international obligations?

I do not see how anyone can hope to find any arrangement that will absolutely equalize the values of anything. Nothing in this world has a constant value so far as I have been able to find out. An ounce of silver may buy four pounds of copper today and tomorrow it may be exchangeable for only three and three-quarter pounds. Similarly with other commodities and services. Mr. Atkins gives as an equation. Value equals $\frac{\text{Resistance}}{\text{Effort}}$. This definition appears too abstract to serve any practical purpose.

Presentation of the subject matter would have gained by condensation without losing any of its force. Many of the diagrams in the book are difficult to comprehend and seem very involved. The book is interesting, however, in showing one engineer's conception of the root of our economic difficulties and his solution. F. E. WORMSER.

Mine Rescue Work—U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,566, 5 pages, is a short report of the third annual mine rescue maneuvers held at Globe, Ariz., last November. Copies may be obtained on request from the Bureau at Washington, D. C.

Mineral Statistics—The Imperial Mineral Resources Bureau has issued two more statistical pamphlets giving world production imports and exports for the years 1919-1921. One covers platinum and allied metals (price 1s. 3½d.) and the other feldspar (price 6½d.). Obtainable from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2, England.

We Do Not Sell Books or Indexed Periodicals

THE *Engineering and Mining Journal-Press* receives numerous requests for copies of the books and periodicals mentioned in these columns. We must emphasize again that we have none of these for sale; the names and addresses of the publishers, together with the price, are given wherever known, and requests should go to them or to a bookseller. McGraw-Hill books are published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City, being housed in a separate building.

Mine Ventilation—Serial No. 2,563, U. S. Bureau of Mines *Reports of Investigations*, 10 pages, is entitled "Effective Temperatures for Still Air Conditions and Their Application to Mining." It is by F. C. Houghten, C. P. Yaglaglou, and R. R. Sayers. The conclusions are as follows: (1) Comfort, as determined by both sense and physiological reactions, depends solely upon effective temperature. At 32 deg. F., the effective-temperature line coincides with the dry-bulb temperature line; hence, in this particular case dry-bulb temperature is the only factor in determining comfort. (2) In the comfort zone, comfort depends equally upon wet and dry-bulb temperatures. (3) At about 132 deg. the effective temperature coincides with the wet-bulb temperature, and for this case the wet-bulb temperature is the only factor. (4) Below 32 deg. the effect of humidity is reversed—that is, the lower the humidity the greater the feeling of warmth. The bulletin may be obtained on request to the U. S. Bureau of Mines, Washington, D. C.

"Physiological Effects of High Temperatures and Humidities With and Without Air Movement" is the subject of a bulletin by R. R. Sayers and D. Harrington, issued as Reprint No. 854, 23 pages, by the U. S. Public Health Service, Washington, D. C., and obtainable on request.

"Distribution of Air in Metal-mine Ventilation, With Especial Reference to Flexible Tubing Methods," by D. Harrington, has recently been issued as an 11-page bulletin of the U. S. Bureau of Mines *Reports of Investigations*, No. 2,551, obtainable on request. The paper was presented in Melbourne last summer before the Pan-Pacific Congress.

Nova Scotia Mining—A "Report on the Mines, 1923," has been issued by the Department of Public Works and Mines, Halifax, Nova Scotia, 215 pages, obtainable on request. Coal is the chief mineral product, but more interest is now being taken in the gold mines of the province, the year's work on which is described in detail.

Kentucky Geology—The Kentucky Geological Survey, Frankfort, Ky., has issued a bound book of 228 pages "Geological Research in Kentucky," being a summary account of the several geological surveys of Kentucky, including a complete list of their publications and a general bibliography of 806 titles pertaining to Kentucky geology.

Patents

Magnesium—No. 1,489,008. April 1, 1924. H. DeC. Richards, San Francisco. Magnesium is obtained from magnesite by treatment of the magnesite with sea water, thus causing the carbonate of magnesium to separate from the calcium and silica. The carbonate is then drawn off from the solution.

Copper Leaching—No. 1,489,121. April 1, 1924. W. E. Greenawalt, Denver. A copper leaching and precipitation process comprising treating ores of copper with a solvent for the copper, precipitating the copper out of the leach solutions as the sulphide; separating the sulphide precipitate from the leach solutions; treating the sulphide precipitate with a ferric sulphate solution to redissolve the copper of the precipitate with the simultaneous reduction of the ferric sulphate to the ferrous sulphate, and electrolyzing the resulting copper sulphate solution containing ferrous sulphate to obtain the electrolytic metal and regenerate ferric sulphate to dissolve more copper from the sulphide precipitate.

Rock Drills—No. 1,488,538. April 1, 1924. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A rotation motor for rock drills. No. 1,488,554. C. V. Plumb, Los Angeles, assignor to Ingersoll-Rand Co., Jersey City, N. J. A centralizer for guiding the drill steel.

Leaching—No. 1,489,362. April 8, 1924. A. J. Moxham, Great Neck, N. Y., assignor to J. P. Laffey, Wilmington, Del. Complex ores are leached with acid to remove the gangue from the metallic portion. The metallic ingredients are then converted to salts which are soluble in water at different rates, a partial separation of the metals being obtained by agitating the mixed salts in water. The separation is completed by heating the dissolved salts to volatilize those that are volatile, and to decompose all of them. Patents Nos. 1,489,360 and 1,489,361 have to do with the production of iron and steel direct-from iron ore by hydrometallurgical methods.

New Machinery and Inventions

New Headlight Designed for Mine Service

An improved type of mine headlight has been developed by the General Electric Co. It has a simple focusing mechanism which adjusts the lamp to the focal point of the reflector by a horizontal movement of the socket. Heavy door pins, hinges, and guard grids add to the rugged construction. The lead entrance is made through a water- and moisture-tight stuffing box and the lead itself is covered with soft but durable rubber, insuring a tight joint. The general contour of the unit is such that blows from falling objects glance off without doing any damage. The casing itself is supported on springs and spherical headed studs, permitting universal movement, and thus absorbing shocks from any direction.

Headlight of rugged construction for mine service

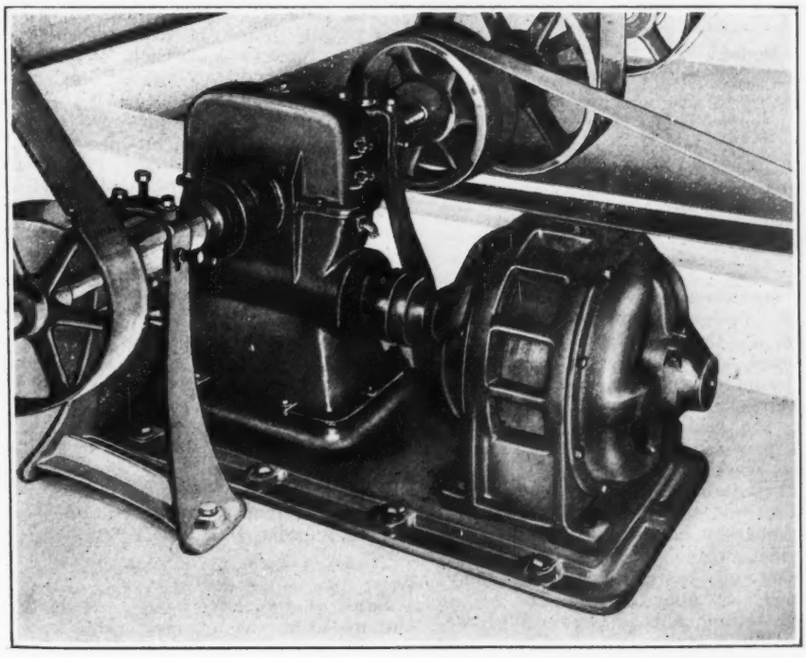
The glass door of the light is recessed in the casing, has a grating heavy enough to withstand severe shock in case of collision, and the glass itself is reinforced with a wire insert. Both door pane and mirror are cushioned with tarred rope for the dual purpose of insuring the interior against dampness and of affording some degree of resiliency in case of shock. The reflector is of heavy glass, silver plated, and has a copper coating to protect the silvering and strengthen the mirror.

This new headlight is known as the H5. Its especially rugged construction is intended to enable it to withstand the rough usage met in mine service.

Inclosed Worm Gear Drive for Line Shafting

There is a tendency in modern plant equipment to inclose all gears and running parts. Following this trend, an inclosed worm-gear drive for operating line shafting may be used to advantage in shops where materials or chemicals detrimental to the life of belting are encountered. Many desirable features are possessed by the drive, among the most important being that it gives an opportunity to use 1,800-r.p.m. motors of a lower cost, with improved power factors and higher efficiency. This, it is claimed, gives better starting conditions.

The connection between the motor and line shaft with these drives is positive, and there is no slip. The power is transmitted with unusual smoothness, which is a decided advantage in any plant. This drive is manufactured by the Cleveland Worm & Gear Co., Cleveland, Ohio.



This worm-gear drive for shafting transmits power smoothly

This Governor Is for Controlling Air and Water Pressure

A new pressure governor shown in the accompanying illustration has been introduced for use in maintaining pressure in air and water systems. It operates in conjunction with magnetic starting panels controlling motor-driven pumps, air compressors, and other equipment. In operation, the governor element is set for a maximum and minimum range of pressure. An auxiliary relay is energized to open the control circuit of the panel when maximum pressure is reached and to close it at the minimum pressure. The electrical connections are so arranged that the governor contacts make contact only, not carrying current or breaking contact, thus insuring longer life of contact tips.

Electrically operated governor for air and water systems

The electrical mechanism is of strong construction. Contact tips are silver plated, to give low resistance contact and to eliminate burning and sticking. The device is inclosed in a cast-iron box with a glass window through which the indicating dial is visible. The complete unit is designed for wall mounting, and is approximately 10 in. square and 4 in. deep. It is made by the General Electric Co.

TRADE CATALOGS

Elevators. A folder has been issued by Doolittle Stephens, Ltd., of Hagersville, Ont., describing a belt-protecting device for use with bucket elevators.

Locomotives. A folder of the Davenport Locomotive Works, Davenport, Iowa, calls attention to the company's line of gasoline locomotives, which are made in 7-ton, 10-ton, 15-ton, and 20-ton sizes. Complete catalogs will be sent upon request.

Motors. The Century Electric Co., St. Louis, Mo., has issued a folder covering its line of repulsion start induction single-phase motor. This motor is made in sizes from ½ hp. to 40 hp.

The Market Report

Daily Prices of Metals

Apr.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
24	13.125@13.375	48.50	49.00	7.95	7.70	6.10@6.125
25	13.125@13.375	48.00	48.50	7.95	7.65	6.05
26	13.125@13.25	49.375	49.875	7.95	7.65	6.00@6.05
28	13.05	48.50	49.00	7.95	7.625	5.95@6.00
29	13.05	47.75	48.25	7.95	7.625	5.90@5.95
30	13.05	47.375	47.875	7.95	7.625	5.90
Av.	13.140	48.250	48.750	7.95	7.646	5.998

*These prices correspond to the following quotations for copper delivered: April 24th and 25th, 13.375@13.625c.; 26th, 13.375@13.50c.; 28th, 29th, and 30th, 13.30c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Apr.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
24	64½	65	69¾	246	245¾	32⅜	30⅝	32⅝	32⅜
25	63⅝	64½	69½	240¼	240	30¾	29½	32	31¾
28	63⅝	64½	69½	243⅜	243⅝	31⅝	30	31¼	31½
29	63⅝	64½	69	240¾	240¾	32	30⅛	31	30⅞
30	63¼	64¼	68¾	236½	236	31¾	30	30¾	30⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver		Gold London	Apr.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
24	4.37½	64½	33	94s 1d	28	4.38⅛	64⅜	33	94s 0d
25	4.37	64½	33⅛	94s 3d	29	4.38⅛	64⅜	33	94s 1d
26	4.38¾	64⅜	33	.....	30	4.37⅞	63⅞	32 13/16	94s 1d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Average Metal Prices for April

Copper:	
New York Electrolytic	13.206
London Standard	64.338
London Electrolytic	70.163
Lead:	
New York	8.263
St. Louis	7.932
London	32.819
Silver:	
New York	64.139
London	33.065
Sterling Exchange	434.788
Zinc:	
St. Louis	6.121
London	32.588
Tin:	
99 per cent	49.457
Straits	49.957
London	250.863
Quicksilver	74.308
Antimony	9.952
Platinum:	
Refined	115.577
Crude	108.077

Metal Markets

New York, April 30, 1924

All metal prices have shown a downward tendency during the last week, the principal reason being the forced selling abroad on the part of German and Austrian speculators. French and British metal dealers were also involved to some extent. The condition has been accentuated in the last two or three days by the fact that it is the end of the month. Similar unsettlement is likely to exist at the end of May and June.

Copper

A large amount of copper was sold on Thursday and Friday, brass and wire manufacturers being particularly active. Prices exhibited a rather wide range, all the way from 13⅜ to 13⅝c. delivered, depending upon the seller, the tonnage, and the delivery point. The largest volume was marketed at 13½c., the price at which most of the large producers were selling. The inquiries were largely for May shipment and they found the producers well sold up for the coming month; certainly little near-by copper is available. In the last three days, business has dropped off materially; prices have dropped, as above stated, owing to forced selling abroad. The 13½c. delivered level at which copper was sold yesterday and today is not generally quoted by producers, but it is all that the two or three anxious sellers can get. Formerly there was little temptation to cut prices when the domestic market was indifferent, because fair sales could be made abroad; but yesterday 13.15c. f.a.s. was all that could be obtained and today the foreign market is closer to 13.00c.

Lead

The official contract price of the American Smelting & Refining Co. was reduced from 8.25 to 8.00c., New York, on Thursday, April 24.

The reduction by the Smelting company was generally expected, as the outside market had been as low as 7.90c. Since last Thursday lead has sold as low as 7¾c., New York, but there has been little pressure to sell and most of the metal has gone out on contract at fixed prices. The cable, pipe, and sheet lead business is reported to be keeping up remarkably well, but there has been a slight slackening in the requirements for batteries, paint, and mixed metals.

The market appears to have reached a resting point at which it may temporarily become stabilized. Producers are all in a comfortable position and at least one of them would use a lull in the market to accumulate a normal reserve stock. The recent readjustment in freight rates from bullion originating in the West has tended to equalize the Chicago and St. Louis quotations for desilverized lead. Inquiries in the lead market increased in number today.

Zinc

Sales of zinc have been good during the week, but at a considerable sacrifice of prices. Some producers have been unwilling to meet the market, so that the business has been largely taken

by one or two interests. High-grade zinc continues to be well taken at from 8 to 8¾c. delivered. New York prices on Prime Western zinc continue at 35c. per 100 lb. above the St. Louis level.

Tin

Consumers continue largely as disinterested observers of the market, even though prices are certainly reasonable compared with those of a few weeks ago. The scarcity of spot tin has now entirely disappeared, and spot and forward metal are selling at almost the same prices, with possibly one-quarter cent less per pound being acceptable for July delivery. Arrivals up to and including April 28 amounted to 10,135 long tons.

Foreign Exchange

The strength in the European exchanges has as yet suffered no particular reaction. On Tuesday, closing cable quotations on francs were 6.465c.; lire, 4.4825c.; and Canadian dollars, 1⅛ per cent discount.

Silver

The market has been quiet but fairly steady, with reported Continental buying. China demands have been slack on weak Eastern exchanges and India has only been a buyer on lower quotations. The market closes weaker in London today at 32 1/16d. on reported China selling.

Mexican Dollars—April 24th, 25th, 26th, 28th, and 29th, 49¼; 30th, 48¾.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 28@29c. per lb.; 98 per cent, 27@28c.

London, 98 per cent, £115 per long ton.

Antimony—Per lb.:

Chinese and Japanese brands, 9¼@9½c.

W. C. C. brand, 12c.

Cookson's "C" grade, 12¾c.

Chinese needle, lump, nominal, 7½ @8½c.

Standard powdered needle, 200 mesh, 9@10c.

White oxide, Chinese, 99 per cent Sb_2O_3, 10@11c.

Market weaker.

Bismuth—$2.40@$2.45 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 3d.

Cobalt—$2.50@$3 per lb. Discounts on contracts. Oxide, $2.10@$2.25. London, 11s. for metal; 9s. for black oxide.

Iridium—$275@$300 per oz. Nominal.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, 90c.@$1 per lb. London quotes 3s. 3d. for 99 per cent.

[1]**Molybdenum**—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £130@£135.

Osmium—$100@$110 per troy oz.

Osmiridium—Crude, $58.50 per oz.

Palladium—$83 per oz. Crude, $60 per oz. London, £17.

Platinum—Refined, $115 per oz. Crude, $108.

London, £28 for manufactured.

Market quiet but firmer.

Quicksilver—$77@$79 per 75-lb. flask. San Francisco wires $72.65. London, £14.

Radium—$70 per mg. radium content.

Rhodium—$100@$105 per oz.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tantalum—Metal, $400 per kg.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 95c.@$1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Per ton, c.i.f. Atlantic ports:

Indian, $19.50.

Rhodesian, $21.50.

New Caledonian, $24.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports:

Old Range, bessemer, 55 per cent iron, $5.65.

Mesabi, bessemer, 55 per cent iron, $5.40.

Old Range, non-bessemer, 51½ per cent iron, $4.90.

Mesabi, non-bessemer, 51½ per cent iron, $4.75.

Magnetite Ore—F.o.b. Port Henry, N. Y., per long ton:

Old bed, 21 furnace, $5.

Old bed, concentrates, 63 per cent, $5.25.

Harmony, cobbed, 63 per cent, $5.25.

New bed, low-phosphorus, 65 per cent, $7.50.

Manganese Ore—44@46c. per long ton unit, seaport, plus duty.

Molybdenum Ore—80c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates. Nominal.

Tantalum Ore—Foreign, 30@50c. per lb. of Ta_2O_5 contained, c.i.f. New York, according to quality.

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite, $9@$9.25.

High-grade scheelite, $9.25.

Ordinary grades, $8.60@$8.75.

Vanadium — Minimum 18 per cent V_2O_5, $1@$1.25 per lb. Nominal.

Zinc and Lead Ore Markets

Joplin, Mo., April 26—Zinc blende per ton, high, $41.00; basis 60 per cent zinc, premium, $40; Prime Western, $39@$40; fines and slimes, $38@$36; average settling price, all zinc ore, $38.06 per ton.

Lead, high, $115.95; basis offering, $90; asking price, $95@$100; average settling price, all lead ore, $104.48 per ton.

Shipments for the week: Blende, 10,500; lead, 2,462 tons. Value, all ores the week, $656,870. Shipment for four months: Blende, 244,756; calamine, 372; lead, 31,107 tons. Value, all ores four months, $13,923,640.

Night work was eliminated at most of the mines within the last two weeks and production is around 3,000 per week less as a consequence.

Operators are paying a wage scale based on $40 zinc, and a miners' union being formed threatens to walk out if the wage is lowered. Sellers feel they cannot maintain the wage and accept less than $40 basis.

Platteville, Wis., April 26—Blende, basis 60 per cent zinc, $41.50 to $42 per ton. Lead, basis 80 per cent lead, $90 per ton. Shipments for the week: Blende, 640 tons; lead, none. Shipments for the year: Blende, 7,802; lead, 272 tons. Shipments for the week to separating plants, 1,520 tons blende.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can only serve as a general guide as to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can only be ascertained by direct negotiation between buyer and seller.

Asbestos:

Crude No. 1—$300@$400.

Crude No. 2—$175@$225.

Spinning fibers—$90@$150.

Magnesia and compressed sheet fibers —$60@$90.

Shingle stock—$50@$70.

Paper stock—$35@$40.

Cement stock—$20@$25.

Floats—$10@$12.

All per short ton, f.o.b. mines, Quebec, tax and bags included.

Little change during month.

No. 1 Rhodesian crude, $325; No. 2, $200 per short ton, c.i.f. New York.

Barytes—Crude—$8 per ton, Missouri mines, 90@98 per cent $BaSO_4$; $9 per ton, f.o.b. Georgia mines; $6 @$8, at Baltimore.

Ground—Off color, $13 per ton, Baltimore; white, $16, Baltimore.

Water ground and floated, $23@$24, f.o.b. St. Louis.

Demand is steady. Manufacturers taking their commitments.

Bauxite—American, f.o.b. shipping point per gross ton:

Crushed and dried, $5.50@$8.75.

Pulverized and dried, $12@$14.

Calcined, crushed, $20.

Foreign, per metric ton c.i.f.:

French, 5 per cent SiO_2, $5@$6.50.

Dalmatian, low SiO_2, $6.50@$7.50.

Other grades, $6.

Inquiries from cement industry increasing.

Beryl—4½c. per lb. f.o.b. Connecticut points. Nominal.

$85 per ton, hand-sorted crystals, f.o.b. New York.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5¼c. per lb.; in bbls., 5½c. Boric acid, 10½c.

Chalk—F.o.b. New York, per lb.:

English, extra light, 5c.

Domestic, light, 4¼@4½c.

Domestic, heavy, 3½@3¾c.

In bulk, $5@$5.50 per ton.

China Clay (Kaolin)—F.o.b. Virginia mines, per short ton:

Crude No. 1, $7.

Crude No. 2, $6.

Washed, $8.50.

Powdered, $13@$20.

Powdered (Blue Ridge), $14@$20.

Imported English, f.o.b. American ports:

Lump, $15@$20.

Powdered, $45@$50.

[1]Price furnished by Foote Mineral Co., Philadelphia.

1A grade, domestic, $16.50@$18, f.o.b. mines.

Diatomaceous Earth—Per ton, f.o.b plant, California:
Kiln-fired brick, $65.
Kiln-fired aggregate, $45.
Insulating powder, $30.
Natural aggregate, $20.

Emery—Per lb., f.o.b. plant:
Greek Naxos, 6½c.
Turkish, 6½c.
Khasia, 5½c.
American, 3½c.
Market fair to good.

Feldspar—Per long ton, f.o.b. cars, *North Carolina:*
No. 1 pottery grade, $7@$7.50, depending upon quality.
No. 2 pottery grade, $4.50@$5, depending upon quality.
No. 1 soap grade, $7.
Ground, 90 to 100 mesh, $10 per short ton.

In *Connecticut*, per net ton, f.o.b. mines:
60 to 80 mesh, $20.
150 mesh, $25.
200 mesh, $30.
Good demand.

In *New Hampshire*, per net ton, f.o.b. mines:
No. 1, not exceeding 10 per cent SiO_2, $8.
No. 2 pottery grade, $7.
Ground, $17@$20, f.o.b. mill.
Demand fair.

In *New York*, per ton, f.o.b. cars:
No. 1, $9.
Demand good.

In *Maine:*
No. 1 ground, $19.
Market better than for a long time.

In *Tennessee:*
No. 1 ground, $15.32@$21 per ton, f.o.b. mill.
Inferior grades, ground, $11@$16 per ton.
Crude, $7 for ordinary grades. As high as $7.50 offered for exceptional quality.

In *Canada:*
No. 1 crude, $7 per short ton.
No 1 ground, 150 mesh, $20.

Fluorspar—F.o.b. western mines, per net ton:
Not less than 80 per cent CaF_2 and not over 5 per cent SiO_2, $22.
Not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $23.
Ground, 93 to 97 per cent CaF_2 and not over 3 per cent SiO_2, $35 in bulk, $39 in bags or barrels.
Acid ground, not less than 98½ per cent CaF_2 and not over 1 per cent SiO_2, $45 in bulk, $49 in packages.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.:
16 to 30 mesh, $16.50.
16 to 60 mesh, $18.
30 to 60 mesh, $18.
60 to 100 mesh, $14.
Plus 100 mesh, $7.50.
Powdered, imported, duty paid, $23 @$25 per ton.

Garnet—Per short ton:
Spanish grades, $60, c.i.f. port of entry.
Domestic Adirondack, $85, f.o.b. shipping point.
Canadian, $70@$80, f.o.b. mines.

Gilsonite—Per ton, f.o.b. Colo.:
Jet asphaltum, $36.
Selects, $33.
Seconds (ordinary grades), $25.50.

Graphite—First quality, per lb.:
Ceylon lump, 5¾@6c.
Ceylon chip, 4¾@5c.
Ceylon dust, 3½@4c.
Crude amorphous, $15@$35 per ton.
Powdered amorphous, 4@15c. per lb.
Flake, finely ground, 3@50c.
Lubricating quality, 7@30c.
Foundry quality, 3@8c.
Market uncertain, prices low and material is sometimes selling below cost.

Gypsum—Per ton, depending upon source:
Crushed rock, $3@$4.50.
Ground, $3.50@$6.
Agricultural, $5@$7.
Calcined, $8@$16.

Ilmenite—Concentrates, 52 per cent TiO_2, 1½c. per lb., f.o.b. Virginia points. $25 per short ton, Florida mines.

Kaolin—See China Clay.

Limestone—Depending upon source, f.o.b. shipping points; per ton:
Crushed, ¾ in. and less, $1.10@$1.70.
Crushed, 3 in. and larger, 90c.@$1.50.
Agricultural, $1.50@$5.

Magnesite—Per ton, f.o.b. California mines:
Calcined lump, 85 per cent MgO, $35.
Calcined ground, 200 mesh, $45.
Dead burned, $32@$34, Washington.
Dead burned, $40@$42, Chester, Pa.
Caustic calcined, Grecian, $50@$51, c.i.f., New York.
Market good.

Manjak—Barbados, in 1 to 5 ton lots:
Grade "A," 8@11c. per lb.
Grade "AA," 9½@12½c. per lb.
Grade "C," fine, 10½@13½c. per lb.
Grade "C," fine and lump, 12@15c.
Grade "C," lump, 13½@16½c.

Mica—
North Carolina prices:
Scrap, $17@$20 per ton.
Sheet, per lb., No. 1 quality, clear:
Punch, 1¼ in., 6c.

1½ x 2 in., 15c.	3 x 4 in., $1.75.
2 x 2 in., 30c.	3 x 5 in., $2.
2 x 3 in., 70c.	4 x 6 in., $3.
3 x 3 in., $1.25.	6 x 8 in., $4.50.

Ground, 60 mesh, $65 per ton.
Ground, 80 mesh, $70.
Ground, 120 mesh, $120.
Ground, 140 mesh, $125.
Other quality, 28 to 120 mesh, $29.50 @$65 per ton.
In *New Hampshire:*
Washer and disk, $280 per ton.
Scrap, $24 per ton.

[1]**Monazite**—Minimum 6 per cent ThO_2, 6@8c. per lb.

Ocher—"Yellow Peruvian," $25@$30 per ton, Georgia mines.

Phosphate — Per long ton, f.o.b., *Florida:*
76@77 per cent, pebble, $6.
75 per cent, $5.50.
74@75 per cent, $5.25.
70 per cent, $3.80.
68 per cent, $3.40.

[1]Price furnished by Foote Mineral Co., Philadelphia.

In *Tennessee*, per long ton:
75 per cent hand mined lump, $6.75.
75 per cent washed lump, $6.75@$7.
72 per cent washed run of mine, $5.50.
65 per cent ground 95 per cent through 100 mesh, $6.50 per short ton.

Potash—Contract prices, per ton:
Kainit, 14@16 per cent, $7.33.

Pumice Stone—Imported lump, 3@40c. per lb.
Powdered, in bbl., 3@5c.
Lumps, in bbl., 6@8c.

Pyrites—Tharsis, per long ton unit, c.i.f. U. S. ports:
Furnace size, 12c.
Lump, 11½c.
Fines, through ½ in., 11½c.
Cinder from ore to remain property of buyers.
Market dull.

Silica—Water ground and floated, per ton, f.o.b. Illinois:
450 mesh, $31.
350 mesh, $25.
200 mesh, $20.
100 mesh, $8.
Market for amorphous silica is good.
Glass sand, $2@$2.50 per ton; brick and molding sand, $2@$2.25.

Rutile—F.o.b. Virginia points, per lb.:
Granular, 94@96 per cent TiO_2, 12@15c.
Pulverized, 100 mesh, 94@96 per cent, 17@30c.
93 per cent TiO_2, 12c., Florida.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; 18@20 for export, f.a.s. New York.

Talc—Per ton, in 50 lb. paper bags, *Vermont* mills, carloads:
Ground, 200 mesh, extra white, $10.50.
Ground, 180 mesh, medium white, $10.
Ground, 160 mesh, medium white, $9.50.
Demand fair. Market firm.
In *New York*, double air-floated, including containers:
200 mesh, $13.75.
325 mesh, $14.75.
100 mesh, $11, not air floated.
Demand good.
In *California*, $20@$30 per ton, ground.
In *Georgia*, powdered, per ton:
White, $12.
Grayish white, $8@$10.
Red, $12@$14.
Yellow, $8.
Roofing, $7.50@$8.

Tripoli—Per short ton, burlap bags, paper liners, per minimum carload 30 tons, f.o.b. Missouri:
Once ground:
Rose and cream colored, $16@$25.
White, $18@$27.
Double ground:
Rose and cream, $17@$25.
White, $19@$30.
Air-float:
Rose and cream, $25@$30.
White, $35.
Super air-float:
Rose and cream, $35@$40.
White, $40@$45.

Zircon—Freight allowed east of Mississippi River:
99 per cent, 6c. per lb., f.o.b. Florida.
Powdered, 7c. per lb., f.o.b. Florida.

Mineral Products

Arsenious Oxide (white arsenic)—10½c. per lb. Nominal.

Copper Sulphate—4.80c. per lb., car lots.

Sodium Nitrate—$2.50 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate—Basis 90 per cent, $41.50 per ton.

Sodium Sulphate—$24@$26 per ton, New York.

Zinc Oxide—Per lb. in bags:
Lead free, 7⅞c.
5 per cent lead sulphate, 7½c.
10 to 35 per cent lead sulphate, 7c.
French, red seal, 9¾c.
French, green seal, 10¾c.
French, white seal, 12c.

Ferro-Alloys

[1]**Ferrocerium**—$7 per lb.

Ferrochrome—1 to 2 per cent carbon, 30c. per lb.; 4 to 6 per cent carbon, 11½c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $107.50 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $36@$38, f.o.b. furnace; 16@19 per cent, $35@$37.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 12 per cent, $41.50 @$46.50 per gross ton, f.o.b. works; 50 per cent, $75 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—85@95c. per lb. of contained W, f.o.b. works. Quiet.

[1]**Ferro-uranium**—35 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works.

Ferrovanadium — $3.50@$4 per lb. of V contained, f.o.b. works. Active.

Metal Products

Rolled Copper—Sheets, 20¾c.; wire, 15⅝c.

Lead Sheets—Full lead sheets, 11.75c. per lb.; cut lead sheets, 12c. in quantity, mill lots.

Nickel Silver—26¾c. per lb. for 18 per cent nickel Grade A sheets.

Yellow Metal — Dimension sheets, 18¼c. per lb.; rods, 15¼c. per lb.

Zinc Sheets—9¾c. per lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$45@$47 per net ton, f.o.b. shipping point.

Firebrick—First quality, $42@$45 per M., Ohio and Kentucky works; $42@$45 Central Pennsylvania; second quality, $35@$38.

Magnesite Brick — 9-in. straights, $65@$68 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick—$38@$40 per M. Pennsylvania; $48@$50 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

[1]Price furnished by Foote Mineral Co., Philadelphia.

The Iron Trade

Pittsburgh, April 29, 1924

Prices are somewhat easier. Bars, shapes, and plates are quotable at 2.25c. to 2.30c. in the Pittsburgh market. The East is no longer on the Pittsburgh basis on bars, shapes, and plates, but has not established its own basing, as Chicago did in the latter part of 1921.

Tin plate production has been curtailed sharply, 10 to 15 per cent from the rate in the first quarter, which was record high.

Pig Iron—A little inquiry is appearing, but the market may still be called quite dull. Bessemer, $22.50; basic, $21; foundry and malleable, $21.50, f.o.b. Valley furnaces.

Connellsville Coke—The market remains dull, with spot prices weak at $3.60@$4 for furnace and $4.75@$5.25 for foundry.

Imports and Exports of Metals and Ores, March, 1924 and 1923

Imports of Ores and Metals

In Pounds, Unless Otherwise Stated

	March, 1923	March, 1924
Antimony		
Ore	.....	266,700
Metal, matte, and regulus	545,440	1,527,893
Copper		
Ore	5,073,427	7,101,243
Concentrates	3,489,000	2,296,864
Regulus, coarse metal, and cement copper	5,060	81,241
Total	8,567,487	9,479,348
Imported from:		
Spain	450,240	548,323
Canada	431,490	665,007
Mexico	5,008,563	2,316,464
Cuba	2,566,797	.....
Chile	57,682	5,685,837
Colombia	.....	41
Peru	20	108,217
Venezuela	14	.....
Other countries	52,681	155,459
Unrefined black, blister, and converter copper in pigs	132,356,984	47,332,796
Imported from		
United Kingdom	11,407	65,604
Canada	3,136,236	2,862,389
Mexico	7,341,620	5,808,720
Chile	7,368,357	13,396,214
Peru	9,900,644	12,413,463
Portuguese Africa	4,320,183	9,231,241
Other countries	278,537	3,555,165
Refined copper	12,307,221	8,361,096
Old and clippings for remanufacturer	620,669	344,835
Composition metal, copper chief value	65,601	.....
Copper manufactures	6,933	2,737
Brass		
Old and clippings for remanufacture	6,582,470	1,367,973
Manufactures of brass	24,618	47,082
Lead		
Ore and matte	179,865	2,822,194
Bullion or base bullion	15,865,342	13,859,011
Pigs, bars, other forms and old	8,483,866	9,243,737
Manufactures of, except type metal	18,521	12,515
Manganese ore, long tons	12,799	46,067
Pyrites, long tons	28,606	17,510
Tin		
Tin ore, tons	61	6
Tin in bars, blocks, and pigs	18,417,799	7,868,637
Imported from		
United Kingdom	5,455,749	721,542
British Straits Settlements	12,077,087	6,252,811
China	2,239	89,690
Dutch East Indies	.....	157,631

Imports of Ores and Metals—Continued

Hongkong	754,378	324,786
Australia	123,200	100,800
Other countries	5,146	221,377
Zinc ore (dutiable)	12,970	.....
Zinc in blocks and pigs (dutiable)	6,717	25
Zinc dust (dutiable)	.....	13,282

Exports of Copper, Lead and Zinc

In Pounds

	March, 1923	March, 1924
Copper		
Ores, concentrates, matte, regulus (copper content)	134,400	2,018
Copper and manufactures of	66,988,345	99,893,243
Refined, in ingots and bars	57,185,756	93,267,807
Exported to:		
Belgium	6,500,732	4,723,518
France	10,990,961	22,602,898
Germany	17,062,928	26,050,640
Italy	4,044,758	4,665,113
Netherlands	448,169	5,107,536
Spain	291,857	22,420
Sweden	1,511,681	2,691,388
United Kingdom	9,125,539	10,896,499
Canada	1,399,942	2,755,656
China	3,617,600	8,456,016
Japan	1,780,484	2,575,788
Other countries	411,105	2,720,335
Old and scrap	169,440	553,728
Composition metal, copper chief value	17,907	3,136
Pipes and tubes	135,785	133,092
Plates and sheets	724,648	702,413
Wire except insulated	.....	.....
Lead		
Pigs and bars:		
From domestic ore	307,450	266,209
From foreign ore	3,502,296	5,199,817
Exported to:		
France	896,284	2,800,838
Germany	.....	672,141
Netherlands	224,080	112,006
United Kingdom	1,924,062	941,077
Other Europe	1,100	336,172
Argentina	224,000	112,030
Brazil	448,112	280,112
Japan	.....	.....
Other countries	92,108	211,650
Zinc		
Dross	1,458,345	415,571
Total zinc slabs and blocks	11,769,008	4,617,160
Exported to:		
Belgium	224,056	112,022
France	649,666	1,232,254
Germany	33,612	1,043,034
United Kingdom	10,695,598	1,389,867
Canada	101,151	139,173
Other countries	64,925	700,810
In sheets and strips	652,533	494,908
Zinc dust	466,121	370,595
Other zinc manufactures	118,054	124,173

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1923	1924	1923	1924	1923	1924
January	65.668	63.447	31.928	33.549	465.053	425.524
February	64.313	64.359	30.875	33.565	468.631	430.457
March	67.556	63.957	32.310	33.483	469.269	428.769
April	66.855	64.139	32.346	33.065	465.220	434.788
May	67.043	.....	32.611	.....	462.252	.....
June	64.861	.....	31.611	.....	461.132	.....
July	63.015	.....	30.942	.....	458.025	.....
August	62.793	.....	30.952	.....	455.714	.....
September	64.263	.....	31.698	.....	453.901	.....
October	63.649	.....	31.718	.....	452.024	.....
November	63.818	.....	32.774	.....	437.839	.....
December	64.705	.....	33.375	.....	435.500	.....
Year	64.873	.....	31.929	.....	457.047	.....

New York quotations, cents per ounce troy, 999 fine, foreign silver. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1923	1924	1923	1924	1923	1924
January	14.510	12.401	64.494	61.273	71.409	67.103
February	15.355	12.708	67.700	63.113	74.500	68.167
March	16.832	13.515	73.851	66.137	81.464	72.087
April	16.663	13.206	73.169	64.338	81.331	70.163
May	15.440	.....	67.460	.....	76.568	.....
June	14.663	.....	66.607	.....	73.238	.....
July	14.321	.....	65.278	.....	72.364	.....
August	13.822	.....	64.034	.....	70.000	.....
September	13.323	.....	63.194	.....	68.275	.....
October	12.574	.....	60.614	.....	64.250	.....
November	12.727	.....	61.648	.....	66.477	.....
December	12.823	.....	62.035	.....	67.611	.....
Year	14.421	.....	65.840	.....	72.291	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1923	1924	1923	1924	1923	1924
January	7.633	7.972	7.571	8.002	27.119	31.528
February	8.050	8.554	8.093	8.643	28.519	34.589
March	8.252	9.013	8.254	8.891	28.815	37.161
April	8.101	8.263	7.996	7.932	26.956	32.819
May	7.306	.....	7.085	.....	25.614	.....
June	7.146	.....	6.852	.....	25.429	.....
July	6.237	.....	6.126	.....	24.188	.....
August	6.582	.....	6.496	.....	24.222	.....
September	6.856	.....	6.700	.....	25.688	.....
October	6.831	.....	6.570	.....	27.815	.....
November	6.846	.....	6.582	.....	30.352	.....
December	7.369	.....	7.369	.....	31.042	.....
	7.267	.....	7.141	.....	27.147	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1923	1924	1923	1924	1923	1924
January	37.986	48.250	39.173	48.750	181.852	246.790
February	40.693	52.772	42.011	53.272	190.513	272.399
March	46.569	54.370	48.569	54.870	219.607	277.429
April	44.280	49.457	45.810	49.957	213.081	250.863
May	42.346	.....	43.135	.....	203.097	.....
June	40.375	.....	40.957	.....	191.798	.....
July	37.970	.....	38.490	.....	181.188	.....
August	38.841	.....	39.269	.....	186.705	.....
September	41.047	.....	41.547	.....	198.263	.....
October	41.322	.....	41.851	.....	203.957	.....
November	43.495	.....	43.995	.....	220.710	.....
December	46.662	.....	47.160	.....	235.007	.....
Year	41.799	.....	42.664	.....	202.148	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1923	1924	1923	1924
January	6.815	6.426	35.733	34.761
February	7.152	6.756	35.613	36.518
March	7.706	6.488	36.720	35.298
April	7.197	6.121	34.275	32.588
May	6.625	.....	31.057	.....
June	6.031	.....	29.548	.....
July	6.089	.....	29.335	.....
August	6.325	.....	32.386	.....
September	6.438	.....	33.469	.....
October	6.293	.....	32.995	.....
November	6.347	.....	32.949	.....
December	6.260	.....	32.611	.....
Year	6.607	.....	33.058	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)		
	New York		New York		Refined New York		Crude
	1923	1924	1923	1924	1923	1924	1924
January	6.884	10.279	72.731	59.500	112.462	122.115	115.500
February	7.290	10.935	70.636	59.565	113.273	124.739	115.935
March	8.885	11.442	70.808	64.269	110.846	121.692	113.231
April	8.380	9.952	69.200	74.308	116.840	115.577	108.077
May	7.477	.....	68.000	.....	115.007	.....	.....
June	6.839	.....	67.769	.....	115.615	.....	.....
July	7.097	.....	66.980	.....	116.000	.....	.....
August	7.753	.....	65.212	.....	116.000	.....	.....
September	7.633	.....	63.000	.....	116.000	.....	.....
October	8.005	.....	61.769	.....	116.923	.....	.....
November	9.156	.....	61.917	.....	124.479	.....	.....
December	9.365	.....	60.000	.....	125.000	.....	.....
Year	7.897	.....	66.502	.....	116.537	.....	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1923	1924	1923	1924	1923	1924
January	29.27	24.76	27.35	23.76	28.77	23.88
February	29.79	25.26	28.15	23.76	27.21	25.06
March	32.03	25.14	31.79	23.76	31.77	24.76
April	32.77	.....	32.77	.....	32.77	.....
May	31.87	.....	29.83	.....	32.46	.....
June	30.27	.....	28.34	.....	29.81	.....
July	28.47	.....	26.52	.....	27.47	.....
August	28.27	.....	26.77	.....	26.77	.....
September	28.76	.....	26.26	.....	26.72	.....
October	26.96	.....	25.01	.....	25.52	.....
November	24.79	.....	22.57	.....	23.60	.....
December	24.54	.....	22.62	.....	23.72	.....
Year	28.94	.....	27.33	.....	28.05	.....

In dollars per long ton.

Monthly Crude Copper Production

Domestic

	1923	1924		
	December	January	February	March
Alaska shipments	6,706,322	5,753,719	8,248,221	9,388,162
Calumet & Arizona	3,876,000	3,764,000	2,824,000	2,084,000
Miami	5,667,345	5,884,000	4,965,000	5,311,000
New Cornelia	3,221,044	3,221,044	4,452,402	5,875,334
Old Dominion	2,156,000	2,344,000	2,250,000	2,100,000
Phelps Dodge	11,114,000	9,818,000	10,112,000	10,597,000
United Verde Extension	4,189,856	3,517,862	3,901,444	3,302,766
A. S. & R. & Tenn. Copper	13,750,000	12,500,000	16,200,000	14,000,000
Imports: Ore and concentrates, matte	13,883,925	10,168,066	17,317,820	9,479,348
Partly from				
Chile	4,486,649	6,755,405	4,795,426	5,685,837
Cuba	3,332,723	.....	1,776,580	.....
Canada	32,433	94,167	5,824,253	665,007
Mexico	1,721,619	1,271,400	2,084,880	2,316,464
Imports of black and blister, unrefined	18,802,829	41,962,680	37,994,544	47,332,796
Partly from				
Chile	569,913	1,664,624	9,552,381	13,396,214
Peru	405,705	7,538,508	5,073,385	12,413,463
Africa	6,364,020	20,525,910	6,090,290	9,231,241
Mexico	4,430,127	7,229,476	5,008,783	5,808,720
Imports of refined and old	20,547,641	16,941,465	13,133,379	[illegible] 18,668

Foreign

Boleo, Mexico	1,378,125	1,486,721	1,356,075	1,454,198
Falcon Mines, Rhodesia	508,000	492,000	494,800	504,952
Furukawa, Japan	2,794,476	2,162,972	2,939,214	(a)
Granby Cons., Canada	2,889,014	3,268,463	2,934,214	3,977,000
Katanga, Africa	10,969,875	11,299,900	11,243,295	13,496,805
Mount Morgan, Aust	1,158,000	493,000	702,000	(a)
Mount Lyell, Aust	882,000	774,000	884,000	(a)
Phelps Dodge Mexican	4,048,000	3,395,000	2,983,000	3,047,000
Sumitomo, Japan	2,829,043	2,713,584	2,806,044	(a)
Wallaroo & Moonta, Aust	(a)	(a)	(a)	(a)

Comparative U. S. Monthly Copper Production

	1921	1922	1923	1924
January	90,596,597	32,010,292	112,267,000	133,356,000
February	86,682,941	45,957,530	102,725,000	128,260,000
March	91,046,345	55,705,760	121,562,000	.....
April	46,946,523	76,601,000	118,157,000	.....
May	25,310,511	88,714,000	125,438,000	.....
June	24,623,693	93,740,000	125,479,000	.....
July	22,033,739	91,000,000	125,249,000	.....
August	23,248,398	101,188,000	131,088,000	.....
September	23,855,316	96,408,000	124,523,000	.....
October	23,231,572	103,273,000	132,481,000	.....
November	28,341,442	102,845,000	127,963,000	.....
December	26,629,137	103,003,000	129,354,000	.....

(a) Not available.

Company Reports

Nipissing Mines Co.

A report of the operations of the Nipissing Mines Co. for 1923 shows dividend payments totaling $1,080,000. Dividends received from Nipissing Mining Co. (a subsidiary) were $1,115,000.

A total of 3,485,545 oz. of fine silver was produced, the net value being (including value of cobalt in residue) $2,340,700. Notwithstanding the fact that nearly 3,500,000 oz. was produced during the year, the known reserves as of Jan. 1, 1924, were decreased only about 500,000 oz. The cost of production per ounce of fine silver was about 2c. less than in 1922, and the milling cost per ton of ore was the lowest in the history of the mill. The ore milled (high and low grade) averaged 44.78 oz.

The surplus was increased by about $283,000 and is as of Jan. 1, 1924, $4,500,000. The policy of vigorously exploring and developing the partly and wholly undeveloped areas was followed during the last year, and will be continued. Also a number of outside properties were investigated, of which several were bonded and one was purchased.

The operations of the Nipissing Mining Co. for 1923 are shown in the following income account and balance sheet:

Gross value of 1923 ore—Nipissing production		$2,353,309.19
Cost of mining and all other expenses	$1,104,019.36	
Less other income at Cobalt	29,503.48	
Net cost of production		$1,074,515.88
Net income for 1923 production		1,278,793.31
Add interest		181,814.14
		$1,460,607.45
Less cost and work on outside properties		62,738.97
Net profit		$1,397,868.48
Surplus Jan. 1, 1923		4,216,950.98
		$5,614,819.46
Less dividends		1,115,000.00
Net surplus—per balance sheet		$4,499,819.46

Balance Sheet, Dec. 31, 1923

Assets

Plant and property	$250,401.23
Current cash and bullion	2,629,712.17
Investments	2,435,617.82
Total	$5,315,731.22

Liabilities and Capital

Capital stock—issued and outstanding	$250,000.00
Current	565,911.76
Earned surplus	4,499,819.46
Total	$5,315,731.22

Callahan Zinc-Lead Co.

A report of the operations of the Callahan Zinc-Lead Co. for 1923 states that the total operating income for the nine months' period of production was $916,559.10, which compares with $149,129.41 in the previous year. Miscellaneous income increased from $19,064.71 in 1922 to $64,424.12 in the period under review. Total income of $980,983.22 compares with a total of $168,194.12 in 1922, and mining, milling, flotation royalties, and general and administrative expenses amounted to $857,453.35. The cost of development and maintenance at the Callahan and Galena properties during the year amounted to $131,463.93, and was charged against operations, leaving a net operating deficit of $7,934.06.

For the nine months' period ended Sept. 30, 1923, when shipments were suspended, 141,611 tons of ore and jig tailings were milled, which compares with 128,781 tons of ore in 1920, the last similar period of operation. The total metallic content of mill feed during the period was 30,476,852 lb. of zinc, 14,304,212 lb. of lead, and 239,845 oz. of silver, compared with 38,100,000 lb., 18,991,830 lb. and 332,650 oz. of zinc, lead, and silver, respectively, in 1920.

The quality of the ore in the lower levels of the mine is reflected in higher per-pound production costs for output, and reduced earnings from operations. Shipments for the nine months were 22,508 tons of zinc concentrates and 7,829 tons of lead-silver concentrates, compared with 28,826 tons and 11,970 tons, respectively, in the ten months of 1920.

Bunker Hill & Sullivan Mining & Concentrating Co.

Silver, lead; Kellogg, Idaho

A report of the operations of the Bunker Hill & Sullivan Mining & Concentrating Co. for 1923 shows a net operating profit of $1,762,107.31. Dividends amounting to $1,635,000 were paid during the year. The report for the period under review is in part:

"Development of the Bunker Hill mine continued in a most satisfactory manner during the past year. Sinking of the main shaft was completed to the No. 17 level, with necessary sump and ore-loading pockets—a depth 1,600 ft. vertically below the Kellogg adit tunnel-level. Crosscutting on this level passed through important ore during December and penetrated the main orebody. This new exposure is very handsome—fully up to the standards of the past in grade and apparent quantity. At this great depth, with rock structure and ore occurrence normal in every way, this disclosure gives assurance of ore resources greater than at any period in the past history of the mine; and, with the strong demand and high current and prospective prices for lead, the continued prosperity of this enterprise is established for an indeterminate long period."

Profit-and-Loss Analysis, 1923

Dr.	Per Ton Concentrates Produced	Value
Production costs (of 72,585.65 tons mill product)		
Mining—425,817 tons mined	$18.95	$1,375,818.86
Milling—427,941 tons mine ore	4.66	338,525.89
Shipping expense—72,308.85 tons concentrates shipped	.32	23,297.82
Smelting costs		
Freight and treatment, and lead and silver discounts	27.67	2,008,472.58
Total production and marketing costs	$51.60	$3,746,115.15

Cr.	Per Ton Concentrates Produced	Value
Production revenue	$81.56	$5,920,135.13
Less production and marketing costs	51.60	3,746,115.15
Mine operating profit—before depletion	$29.96	$2,174,019.98
Other revenue (mainly Bunker Hill smelter)		$150,328.83
Operating surplus before depletion		$2,324,348.81
Deduct depletion for 1923	562,241.50	
Operating profit after depletion		$1,762,107.31
Deduct income taxes accrued for 1923		220,337.08
Balance to surplus		$1,541,770.23

Balance Sheet, Dec. 31, 1923

Property and Assets

Property and plant, balance Dec. 31, 1922		$41,388,962.49
Mining claims—miscellaneous expenditures in year		3,874.18
Construction and equipment added, 1923		797,123.45
		$42,188,960.12
Less		
Depreciation for year	$294,666.88	
Depletion for year	562,241.50	
		856,908.38
		$41,332,051.74
Miscellaneous supplies		708,028.73
Ore accounts		717,168.89
Investment reserve		1,164,601.85
Cash accounts		76,137.01
Outside investments		1,601,175.70
Miscellaneous mining stocks		158,307.00
Miscellaneous accounts receivable (including lead sales)		705,977.03
Employees' building loans		60,094.60
Light and water department accounts		27,753.74
Other assets		27,763.62
		$46,579,059.91

Capital and Liabilities

Capital stock—327,000 shares at $10 each	$3,270,000.00
Notes payable—Crocker National Bank	150,000.00
Mine and smelter drafts, checks, and vouchers outstanding	280,864.86
Taxes reserve	52,789.62
Due lessees and other liabilities	61,714.24
Mine accident awards	50,702.62
Due Bunker Hill smelter	21,180.84
Normal surplus	8,000,455.90
Property revaluation surplus	34,471,014.75
Income taxes accrued	220,337.08
	$46,579,059.91

Production amounted to 69,757,010 lb. of lead and 1,177,630.6 oz. of silver in concentrates milled from 425,817 tons of ore. Cost per pound of lead was 5.37c.

Mining Stocks

Week Ended April 26, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	....	....	*15	....	....
Anaconda	New York	33¼	31½	32¼	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1½	1	1½	....	....
Ariz. Com'l	Boston	9	9	9	Ja.15, Ja.31	0.50
Calaveras	N. Y. Curb	....	....	1⅛	....	....
Calumet & Arizona	Boston	46½	43¼	46½	Mc.7, Mc.24, Q	0.50
Cal. & Hecla (New)	Boston	15⅝	15	15½	De. 1, De. 17	0.50
Canario Copper	N. Y. Curb	2⅛	2 1/16	2⅛	....	....
Cerro de Pasco	New York	45⅜	43¼	44¼	Ap. 17, My. 1	1.00
Chile Copper	New York	27⅛	26⅛	27⅜	Jn.2, Jn.30, Q	0.62½
Chino	New York	16⅛	16	16⅛	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	2⅞	2⅜	2⅜	....	....
Copper Range	Boston	23	21½	22¼	May, 1923	1.00
Crystal Copper	Boston Curb	75	72	73	....	....
Davis-Daly	Boston	*65	*50	*60	Mar., 1920	0.25
East Butte	Boston	4⅜	4¼	4¼	Dec., 1919	0.50
First National	Boston Curb	30	27	27	Feb., 1919,	0.15
Franklin	Boston	*75	*75	*75	....	....
Gadsden Copper	Boston Curb	....	....	*40	....	....
Granby Consol.	New York	14	12¼	14	May, 1919	1.25
Greene-Cananea	New York	13½	12⅝	12⅝	Nov., 1920	0.50
Hancock	Boston	1	1	1	....	....
Howe Sound	N. Y. Curb	2⅛	2⅛	2⅛	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	25	24	24¼	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	3	3	3	May, 1923	0.15
Isle Royale	Boston	15	14	14½	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	....	....	1⅛	....	....
Jib Consol	N. Y. Curb	*24	*19	*19	....	....
Kennecott	New York	38⅜	37⅛	38⅛	Mc.7, Ap. 1, Q	0.75
Keweenaw	Boston	*50	*50	*50	....	....
Lake Copper	Boston	1½	1½	1½	....	....
Magma Copper	New York	33½	31½	31⅝	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛	....	....
Mass Consolidated	Boston	*50	*50	*50	Nov., 1917	1.00
Miami Copper	New York	22½	21⅜	22⅛	My.1, My.15, Q	0.50
Mohawk	Boston	*30	*28	*29½	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8⅛	7⅞	8	De.14, De.31	0.50
Nevada Consol.	New York	13	12⅛	12⅞	Sept., 1920,	0.25
New Cornelia	Boston	18⅛	17⅞	18	My.9, My.26,	0.25
New Dominion	N. Y. Curb	2⅜	2⅜	2⅜	....	....
North Butte	Boston	2⅜	2⅛	2⅛	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	*70	*68	*69	....	....
Old Dominion	Boston	18⅛	17⅞	18	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†130	†120	....	Mc.24, Ap.2	Q 1.00
Quincy	Boston	18⅛	17⅛	18	Mar., 1920	1.00
Ray Consolidated	New York	10	9⅝	10	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*13	*13	*13	....	....
St. Mary's Min. Ld.	Boston	31	28	31	Ap.22, My.20	3.00
Seneca Copper	New York	1⅛	1	1	....	....
Shannon	Boston	*36	*35	*35	Nov., 1917	0.25
Shattuck Arizona	New York	5⅜	5⅛	5⅜	Jan., 1920	0.25
South Lake	Boston	....	....	*25	....	....
Superior & Boston	Boston	*70	*40	*70	....	....
Tenn. C. & C. cfs.	New York	7⅛	6⅞	7⅛	De.31, Ja.15, Q	0.25
Utah Copper	New York	67⅛	65⅛	67	Mc.14, Mc.31, Q	1.00
Utah Metal & T.	Boston	*38	*29	*30	Dec., 1917	0.30
Victoria	Boston	*15	*15	*15	....	....
Walker Mining	N. Y. Curb	3⅛	3	3 1/16	....	....
Winona	Boston	*20	*20	*20	....	....
NICKEL-COPPER						
Internat. Nickel	New York	12⅜	12	12⅛	Mar., 1919	0.50
Internat. Nickel pfd.	New York	77⅛	77⅛	77⅛	Ap.17, My.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	5⅜	5⅛	5⅜	....	....
National Lead	New York	132	123⅛	131⅛	Mc.14, Mc.31, Q	2.00
National Lead pfd.	New York	113	112½	113	My. 23, Ju. 14, Q	1.75
St. Joseph Lead	New York	24	23⅛	23⅜	Mc. 20, 1924	0.50
ZINC						
Am. Z. L. & S.	New York	7⅛	7⅛	7⅛	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	....	....	26	Nov., 1920	1.50
Butte C. & Z.	New York	5⅛	4⅞	5⅛	Ma.., 1923	0.50
Butte & Superior	New York	16	14⅞	16	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	4⅛	4	4	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	140	135⅛	135⅛	Ap.30, My.10, Q	2.00
United Zinc	N. Y. Curb	....	....	*25	....	....
Yellow Pine	Los Angeles	80	80	80	Mar., 1924	0.04
SILVER						
Alvarado	N. Y. Curb	....	....	1⅜	....	....
Beaver Consol.	Toronto	....	....	*22½	May, 1920	0.03
Castle-Trethewey	Toronto	*76	*75½	*75½	....	....
Coniagas	Toronto	2.00	1.90	1.90	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*60	*54	*55½	Jan., 1917	0.05
Keeley	Toronto	†2.28	†2.26	2.18	....	....
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	*16	*16	*16	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.34	1.33	1.33	....	....
McKinley-Dar.-Sav.	Toronto	*13	*12½	*13	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.20	3.20	3.20	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6⅛	5⅛	5⅛	Mc.1, Ap.21, Q	0.03½
Ontario Silver	New York	6	6	6	Jan., 1919	0.50
Temiskaming	Toronto	*26	*26	*26	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅜	⅜	⅜	....	....
Alaska Juneau	New York	1⅛	1⅛	1⅛	....	....
Argonaut	Toronto	*49¼	*48	*49⅜	....	....
Carson Hill	Boston	1⅛	1⅛	1⅛	....	....
Cresson Consol. G	N. Y. Curb	3⅛	3⅛	3⅛	Mc.3, Ap.10, Q	0.18
Dome Mines	New York	16⅛	15⅛	15⅛	Mc.26, Ap.21, Q	0.50
Golden Cycle	Colo. Springs	....	....	1.34½	Dec., 1922	0.02
Hollinger Consol.	Toronto	†13.10	†12.90	12.60	My.1, My.19, M	0.05
Homestake Mining	New York	50	49½	50	Ap.19, Ap.25, MX	1.50
Kirkland Lake	Toronto	....	....	21⅛	....	....
Lake Shore	Toronto	3.88	3.82	3.84	Fe.2, Fe. 24, Q	0.02
McIntyre-Porcupine	New York	15⅞	15⅛	15⅛	Ap. 1, My. 1,	0.25
Newray	Toronto	32⅛	32	32	....	....
Portland	Colo. Springs	....	....	*62	Oct., 1920	0.01
Teck-Hughes	Toronto	†1.20	†1.14	1.13	....	....
Tom Reed	Los Angeles	28	25	27½	Dec., '1919	0.02
Tough-Oakes	Toronto	†*68	†*66	*65	....	....
United Eastern	N. Y. Curb	*64	*62	*62	Ap 10, Ap.28, Q	0.10
Vipond Cons.	Toronto	†1.14	†1.12	1.06	....	....
Wright-Hargreaves	Toronto	3.00	2.95	2.95	Mc.15, Ap. 1, Q	0.02½
Yukon Gold	N. Y. Curb	*66	*66	*66	June, 1918	0.02
GOLD AND SILVER						
Con. Cortez	N. Y. Curb	*50	*33	*38	....	....
Con. Virginia	San Francisco	5⅛	4⅛	5⅛	....	....
Continental Mines	N. Y. Curb	....	....	2⅛	....	—
Dolores Esperanza	N. Y. Curb	....	....	*37	Jy. 1, Jy. 10	Q 0.05
Premier Gold	N. Y. Curb	2	1⅞	1⅞	Mc.28, Ap.5	0.08
Tonopah Belmont	N. Y. Curb	*55	*52	*55	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*28	*27	*27	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2⅛	2	2⅛	Mc. 11, Ap. 1	0.05
Tonopah Mining	N. Y. Curb	1⅞	1⅞	1⅞	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1⅛	1⅛	1⅛	....	....
West End Consol.	N. Y. Curb	*55	*53	*55	Mar., 1923	0.05
SILVER-LEAD						
Ahumada	Boston Curb	6	5⅜	6	Mc., Ap. 2, X	0.15
Bingham Mines	Boston	†*17	†*15	15	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake	85	82	84	Dec., 1920	0.15
Chief Consol.	Boston Curb	3⅛	3 1/16	3 1/16	Ap 19, My.1, Q	0.10
Columbus Rexall	Salt Lake	*25⅛	*25	*25⅛	Aug., 1922	0.03
Consol. M. & S.	Montreal	34⅜	34⅛	34⅜	Oct., 1920	0.62½
Daly Mining	Salt Lake	....	....	205	July, 1920	0.10
Erupcion	Boston Curb	....	....	2⅜	Mc. 15, Ap.2, X	0.15
Federal M. & S.	New York	8	5⅜	8	Jan., 1909	1.50
Federal M. & S. pfd.	New York	43⅛	42½	43⅛	Fe.26, Mh.15, Q	1.75
Florence Silver	Spokane	*17½	*13⅛	*14½	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	8⅛	8⅛	8⅛	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb	*28	*27	*27	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	*8	*8	*8	June, 1921	0.02½
Park City	Salt Lake	....	....	4.75	Mar., 1924	0.15
Park Utah	N. Y. Curb	....	....	3⅛	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	....	....	*75	Nov., 1917	0.02
Silversmith	Spokane	*44⅛	*43⅛	*44⅛	Ap. 1, Ap. 10	0.01
Tamarack-Custer	Spokane	1.97	1.87	1.87	Se.30, Oc. 1, K	0.02
Tintic Standard	Salt Lake	4.35	4.05	4.10	Mar. 25, 24, QX	0.15
Utah-Apex	Boston	2⅛	2⅛	2⅛	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	52	48⅛	51⅛	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	⅛	⅛	⅛	....	....
Char. Iron pfd.	Detroit	1 1/16	1 1/16	1 1/16	....	....
Colorado Fuel & Iron	New York	35⅛	30⅛	34⅛	My.10, My.26	Q 2.00
Col. Fuel & Iron pfd.	New York	....	....	102	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	27⅛	27	27⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	....	....	46	Mh.15, Apl. 1	Q 0.62½
Mesabi Iron	N. Y. Curb	5	5	5	....	....
Replogle Steel	New York	9	8⅛	9	....	....
Republic I. & S.	New York	47⅜	44⅛	47⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	....	....	86	Mh.20, Ap.1	QX 2.75
Sloss-Sheffield S.&I.	New York	57⅛	55	57⅛	Feb., 1921	1.50
Sloss-Shef. S.&I.pfd.	New York	....	....	80	De.20, Ja.2, Q	1.75
U. S. Steel	New York	101	95⅛	100⅞	Mc. 29, QX	1.75
U. S. Steel pfd.	New York	119⅛	118⅛	119	Mc. 29, Q	1.75
Virginia I. C. & C.	New York	45	40	40	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York	76	74	74	De.15, Ja.22	2.50
VANADIUM						
Vanadium Corp.	New York	24⅛	22⅛	24	Jan., 1921	1.00
ASBESTOS						
Asbestos Corp.	Montreal	....	....	28	Se.29, Oc.15	Q 1.00
Asbestos Corp. pfd.	Montreal	55	55	55	Ap.1, Ap.15, Q	1.50
SULPHUR						
Freeport Texas	New York	9⅛	8⅛	9⅛	Nov., 1919,	1.00
Texas Gulf	New York	58⅛	57⅛	58	Mh.3, Mh.15	QX 1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅜	....	....
MINING, SMELTING AND REFINING						
Amer. Metal	New York	42⅛	42⅛	42⅛	My.20, Jn.1, Q	0.75
Amer. Metal pfd.	New York	....	....	109⅜	My.20, Jn.1, Q	1.75
Amer. Sm. & Ref.	New York	61⅛	59⅛	61⅛	Ap. 11, My.1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	98⅛	97⅞	97⅞	My. 9, Jn. 1,	1.75
U. S. Sm. R. & M.	New York	20⅛	19⅛	20	Jan., 1921,	0.50
U.S. Sm. R.&M.pfd.	New York	38	38	38	Ap.15, '24, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial, X, Includes extra.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.